EDP industry report

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EDP industry report
● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

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● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR APRIL 15, 1983 ● V/18, NO/24 P.J. MCGOVERN, PUBLISHER

IBM RELEASES MVS/XA DETAILS, CONVERSION BATTLES READY TO COMMENCE

Conversion. It may be the ugliest word in the computer industry, upsetting the old order, forcing complex decisions, and tying up a user's best people in largely unproductive tasks. The bigger the system, the worse it gets.

Thus it is not surprising that the mainframe world was eagerly awaiting IBM's MVS/XA performance specifications. Users all too easily recognized the human and machine resources that would be required, but were not sure about the payoff. IBM, on the other hand, could not afford to offer too dramatic a change, for fear of starting a conversion rush it could neither manage nor support. The announced specifications reflect this timeworn juggling act.

IBM has clearly implied that only those customers experiencing significant constraints can expect major improvements when operating under /XA. In unconstrained environments, there is little incentive to move, except as a means to prepare for the inevitable. The situation is reminiscent of SNA, whose acceptance has been a slow walk along the cost justification curve. Some key facts:

- Virtual storage relief. The /XA user can expect to get from 1.3MB to 2.1MB of virtual storage relief as subsystems are moved to areas above 16MB; in constrained environments this can be significant. IBM says it intends to provide further relief.

- Performance. In unconstrained environments, MVS/XA has an unimpressive throughput comparison of between +6% and -7% compared to MVS/370, based on a 3081K with 32MB and 24 channels. The high numbers are for TSO environments; the low ones in DB/DC use. Batch falls in the middle. For equivalent traffic, 3380 response time is said to improve up to 30% with the dynamic channel capabilities of /XA.

- Conversion. Since the VM migration aid isn't ready, /XA development can't be run concurrently with non-XA production, but the bi-modal software allows 24-bit and 31-bit applications to run concurrently.

- Memory requirements. Not surprisingly, /XA is a memory hog, and new 48MB, /XA-only versions of the 3081K and 3081G have been announced. An extra 16MB will yield an additional 10% improvement in TSO use.

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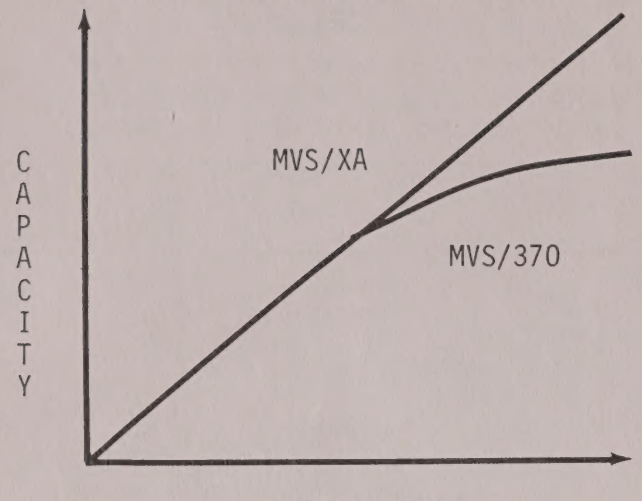
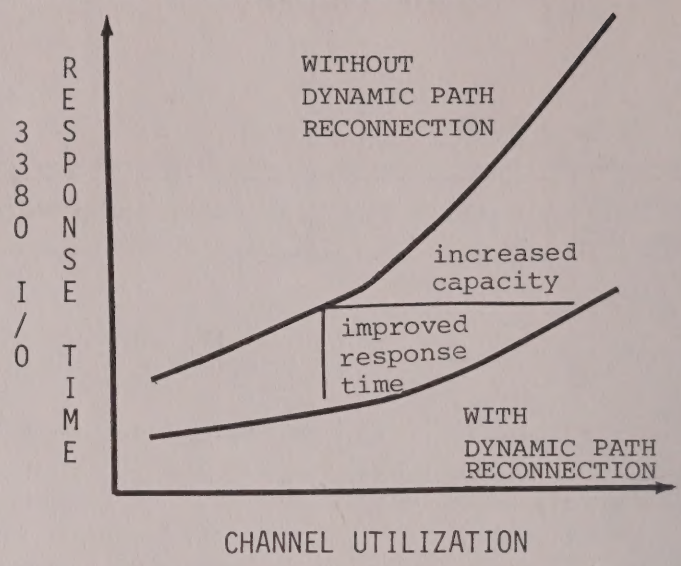
IBM'S ESTIMATES OF /XA CPU AND DISK PERFORMANCE IMPROVEMENTS





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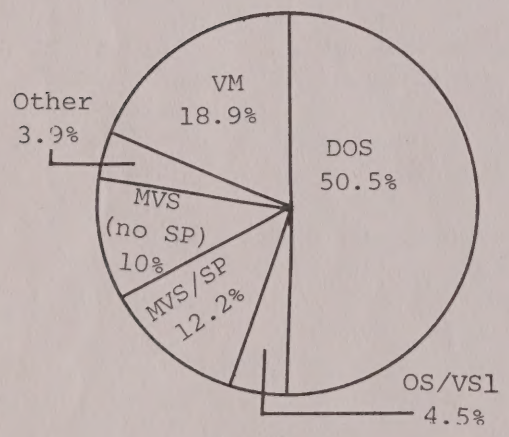

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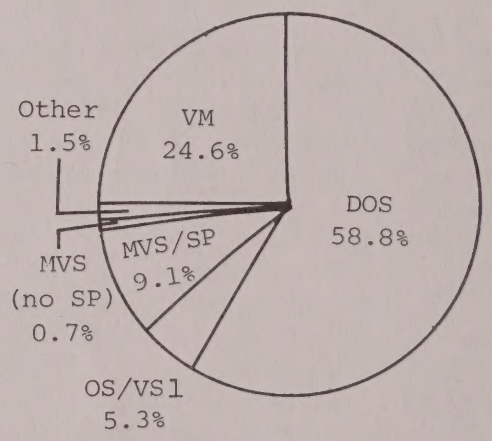

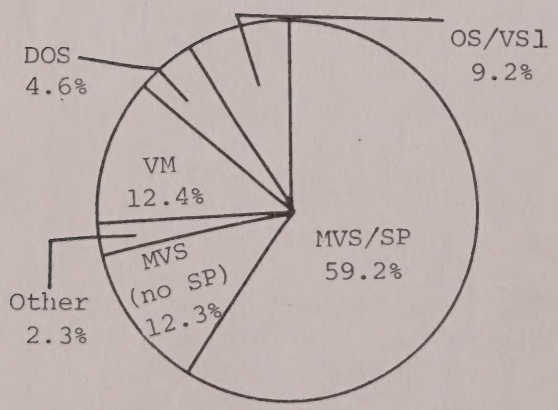

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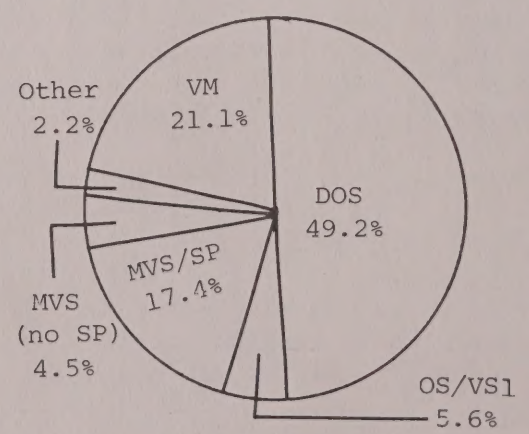

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Migration to /XA

As the data on page two shows, the vast majority of IBM users will not even be considering migration to /XA. Looking at the giant's U.S. base, IDC's latest software survey indicates that only 17.4% of the installed CPUs are running MVS/SP, and many of these have yet to go to release 1.3 which, along with 308X hardware, is the necessary stepping-stone to /XA. The picture of the high end is different. Nearly 60% of the 30XX family is running MVS/SP. On the new 3081s and 3083s, the figure is close to 90%.

Those contemplating migration will find the path expensive. A spokesman for NAS estimates that if a user employs the VM migration aid (which partitions the system into two virtual CPUs), first year software license costs could reach some $120,000, compared to some $20,000 for MVS/SP. The former total includes $23,850 in one-time initial fees. Even if the migration aid and the one-time fees are excluded, monthly software charges will more than double. Add to this the significant people costs and the necessary hardware resources.

PCM position

MVS/XA presents the PCMs with many interesting challenges. With the collapse of Magnuson, significant PCM success appears likely to be limited to the high end. It is also true that the PCM customer base includes many sophisticated users, precisely the two groups most likely to want to move up to /XA.

Both Amdahl and National Advanced Systems are expecting strong shipments this year, indicating that a fear of /XA hasn't permeated their market. But if the PCMs want to keep this group from drifting back toward IBM, they must give some evidence of their ability to support /XA in the 1984-86 time frame, otherwise their market will slowly become limited to those not on the /XA track. The PCMs say they're confident that they can meet the /XA challenge.

The PCMs are also quick to point out what can happen to conversion pioneers. MVS/XA contains an enormous amount of new code that has yet to be tested under diverse market conditions. Parallels to the difficulties in the early days of MVS/MVT/SVS are easily drawn, and since the VM migration aid won't be available until December 1983, most users might be wise to wait and see for 1983.

IBM says that the results of its recent Share user's meeting suggest that migration to /XA will be much easier than the conversion from MVT to MVS and may even be easier than the jump to MVS Release 1.3. A spokesman said that the bimodal software (for 24- and 31-bit programs) has been running smoothly.

Announcement overview

IBM lists eight major new capabilities offered by /XA. They are: 24 channels on a uniprocessor system (up from 16); support of the four processor 3084 in a single image mode; dynamic channels; 2GB virtual storage; up to 2.1MB of virtual storage relief; improved resource management algorithms; increased real storage capability; and support for 4,096 devices (up from 1,917).

The giant also announced several new products: MVS/SP 2.1.1 and MVS/XA DFP 1.1 (6/83) promising 558KB VS relief, 31-bit VSAM and support for the 3880 Mod 11; CICS/OS/VS 1.61 (8/83) offering improved performance and better use of dyadic systems; RMF 3.2 monitoring system (10/83); and 48MB 3081G,K (4Q/83).

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INTEREST IN ARTIFICIAL INTELLIGENCE HEIGHTENS,
AS JAPANESE FIFTH GENERATION PROJECT GETS UNDERWAY

"Recent advances in device technology as well as progress of basic research have inspired us with the feeling that innovative computers will emerge in the near future." -- Kazuhiro Fuchi, Director, ICOT Research Center

The so-called Japanese fifth generation computer project has been called everything from a paper tiger to the modern equivalent of the Manhattan Project. Politics, nationalism, and the fear and mystery of Artificial Intelligence (AI) have further complicated an already intrinsically difficult subject.

The 5th generation label itself is misleading. The first four generations (presumably vacuum tubes, transistors, integrated circuits, and VLSI) have essentially been defined by generations of components. Fifth generation systems, although incorporating further circuitry advances, are expected to be primarily characterized by software and architectural innovation. Thus, the 5th generation is really a second generation, non-Von Neuman machine, whose arrival is not nearly as predictable as the increasing sophistication of hardware.

On the other hand, such "knowledge machines" would be radically more important than any hardware improvement. Historians like to point out that a small factor such as the superiority of the Greek alphabet was crucial to the Hellenization of Western thought, and that the use of the printing press was the key to the European cultural hegemony of the last 600 years. The development of intelligent machines could well be the key to the next phase of world cultural domination, with Japan and the U.S. vying for center stage. Some thoughts:

- After much talk about international cooperation, the Japanese effort is increasingly looking like a national project. As of now, ICL and CII Bull are the only non-Japanese companies participating.

- Although the scale of the Japanese effort is impressive, the sum of total U.S. activity is significantly greater. Whether a single large project is superior to 50-100 small ones remains to be seen.

- Because of the attributes of Asian languages, the Japanese are much more interested in pattern recognition and voice than U.S. researchers. Pattern recognition is also important to the Arabic world.

- Much of the Japanese effort to date has consisted of gathering the results of diverse Western projects, and the pooling process alone should prove worthwhile.

- Knowledge or "inference machines" are expected to consist of an integration of known but little-used concepts such as: parallel and associative processing, data base machines, predicate calculus, functional languages, axiomatic semantics and others.

U.S. researchers have had significant success with "expert systems" such as Intern and Mycin, and the Japanese hope to universalize these efforts. At the recent Computer Culture symposium sponsored by the N.Y. Academy of Sciences, AI author Pamela McCorduck likened today's expert systems to the custom cars of the 1890s. The Japanese, she added, are trying to build the first AI version of the Model T -- general-purpose, dominant, and widely available.

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Research and development schedule

	Initial stage	Interim stage	Final stage
Basic application system	(1) Preparing the basic systems (grammars, recognition systems, description systems) (2) Collection and systematization of basic data (conversation data, terminology data base, formula base) (3) Trial production of an experimental system	(1) Setting up interim targets (a system to support translation involving 5,000 words: a specialized question answering system involving 2,000 words and 1,000 rules: speech understanding system handling simple sentences: a system retrieving 10,000 picture and image data items: a algebraic formula manipulation system using formula base: Go-playing system of subgrade 10 level.) (2) Draft specifications for the final target (3) Trial production of hardware for specialized use	(1) Development of final targets (a multi-lingual translation system involving 100,000 words: a question answering system involving 5,000 words and 10,000 rules: a sophisticated phonetic typewriter: a system retrieving 100,000 graphic and picture data items: a formula understanding system with a knowledge base: Go-game playing system at the grade level.) (2) Development of hardware fo for specialized use
Basic software system	(1) Determination (initial stage) of specifications for a core language (such as PROLOG) prior to primary specifications (2) Basic study on the respective software items and laying down the primary specifications (3) Trial production of some of the systems and collection of data	(1) Improvement and extension of the core language laying down the final specifications oriented to machine software (secondary specifications) (2) Trial production of a knowledge base management system on a relational data base machine (3) Development a prototype intelligent interface on a development-supporting machine Hardware specifications for specialized use (4) Drafting the new theoretical system	(1) Intermediate target machine simulator (2) Target system specifications (3) Development of a target system (4) Improved processing of the core language through addition of say, knowledge base enquiry function (5) Development of a final system, integrating it with the fifth generation machines (6) Establishment of a new theoretical system
New advanced architectures	(1) Evaluation of the proposed machines through simulation, and collection of basic data (2) Trial production of some of the experimental machines (3) Development of the firmware-based PROLOG and LISP machine to support development	(1) Incorporating the results of initial evaluation into machines proposed (2) Trial production of a medium-scale experimental machine (using VLSI of the first edition) Support to trial production of software (3) Extending the scope of machine to support development of a firmware base and application of VLSI for personal use	(1) Finalization of the proposed machines and their specifications (2) Development of a prototype and its combination with the software. Fifth generation prototype machine (use of second edition VLSI)

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	Initial stage	Interim stage	Final stage
Distributed function architecture	(1) Establishment of a method of designing distributed function architecture design method (2) Basic study on distributed OS and local network techniques (3) Expansion of local network for development supporting	(1) Development of a distributed function network (super-personal computer network) including development-supporting machines (2) Development of distributed OS and related software, and hardware like data base machines (3) Trial production of UHM, supporting its use in personal computers	(1) Expansion to a distributed function network with the fifth generation prototype machine as its core (2) Development of intelligent interface hardware
VLSI technology	(1) Support to the new advanced architectures with customized LSI (2) Study and trial production of software for VLSI-CAD and organizing CAD (3) Basic study on architecture for VLSI	(1) Support to the study of new advanced architectures with customized VLSI (2) Development of a VLSI-CAD system and making it available for use (3) Development of an architecture data base for VLSI	(1) Supporting development of a prototype with customized VLSI (2) Expansion to intelligent VLSI-CAD (3) Conversion of VLSI architecture into a knowledge base
Systematization technology	(1) Basic studies on the method of system construction (modularization hierarchic organization) (2) Basic studies on knowledge base design (3) Basic studies on life cycle management technique	(1) Studies on expansion and diversification of systems (2) Standardization of interfaces between the hierarchic levels (3) Design and development of a system to support systematization (vertification and synthesis of programs, supporting design and development of knowledge base) (4) Development of a system evaluation tools	(1) Enlargement of a system to support systematization (support to expansion and diversification, design consultant system) (2) Development of a design supporting systems and development for a large system (3) Development of maintenance, improvement and management systems
Development supporting technology	(1) Installation of local network to support development and connecting the development-supporting machines (2) Establishment of a simple global network using public telephone line and connecting the development supporting machines (3) Expansion of PROLOG, LISP machines as development supporting tools (4) Organizing LSI-CAD (5) Development of software development support system (language processing, editor, data base) (6) Development of an expert system to build up a knowledge base	(1) Installation of a local network applying the distributed function architecture (expansion and updating of the local network) (2) Expansion of the global network using public telephone lines and installation of a data base station (3) Supporting development with a superpersonal computer using a core language (first edition) (4) Development and utilization of a distributed data base	(1) Supporting systematization by expanding the distributed function system and local network (2) Expansion of the global network

Source: Japan Information Processing Development Center (JIPDEC)

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The Japanese project

Unlike the situation in the U.S. where the subject of AI is generally viewed with a blend of skepticism and fear, the Japanese project has at least some of the trappings of a national crusade. Kazuhiro Fuchi, director of the Institute for New Generation Computer Technology (ICOT), says that the Japanese view the project as both a symbol of the nation's new emphasis on creativity as well as a means to establish Japan as a contributor to world knowledge and prosperity.

Best estimates are that some $850 million is scheduled for the project over the next 10 years, although the project itself is viewed as a 25-year effort. This figure represents pure research and thus should not be compared to the $50 million spent to design and develop Apple's Lisa. Several researchers interviewed estimated that development costs are often 90% of an R&D budget and thus the $85 million/year figure suggests a large, but not overwhelming, commitment.

As for international cooperation, it looks like most western observers will have to be content to wait for research publications. Efforts will apparently be made to translate and release project results, but this remains to be seen. On the other hand, it is doubtful how much of the Defense Department's AI work or the work proposed by the Microelectronic and Computer Technology Enterprise will ever be made available to the Japanese.

What is certain is that currently no U.S. firms are formally involved in the project, nor are any subsidiaries of U.S. firms -- IBM Japan, Nippon Univac, etc. According to one source, Japan-based subsidiaries of U.S. firms are eligible to be charter members of the project if they are willing to pledge about $50 million and some key manpower, but so far none have stepped forward.

User interfaces

Although only a minor subset of the AI task, natural user interfaces are receiving lots of attention due to the spread of personal computers and other forms of end-user demand. For the first time, major vendors are seriously consulting with psychologists, and there is now even a discipline called "Human/Computer Interaction," the topic of a recent meeting which drew 600 attendees.

According to Donald Norman, director of the Institute of Cognitive Science at UC, San Diego, there is a real need to separate the interface routine from the computing application. This would allow for personalized interfaces that meet the needs of many different users without affecting internal machine behavior. A separate interface processor might well be the eventual answer.

Perhaps because of overblown vendor claims, defining and measuring user-friendliness has also become an issue. Alphonse Champanis, director of Johns Hopkins' Communications Research Laboratory, proposes the following method:

> *"Ease of use is inversely proportional to the time it takes to train a representative sample of users to a level of proficiency such that at least 90% of them can do their work with a computer as fast as, and with no more errors than they could do the same work without it."*

The question comes down to who's being least realistic. Vendors expecting users to think like programmers, or users who want a computer to work as simply as a toaster. The search is for the middle ground.

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• IBM ENHANCES S/1 AND S/38. The top-of-the-line Series/1 model 4956 is the first to use 64K chips and offers 20% more performance and double the main storage (to 1MB) than the 4955F. A 1MB version costs $21,650. Other improvements include: the 4767 high performance 200MB disk system ($30,000) which has the first intelligent cache (380KB) for a small IBM computer; attachment of 5224 or 5225 line printers; attachment of the IBM PC; and the 4968 autoload streaming tape drive, OEMed from Cipher. All shipments begin between June and August.

As for the S/38, the new model 8 offers double the main storage (up to 8MB) and can support 60% more workstations (up to 128). Users can now also attach IBM's 3370 drives. Support of Basic was also announced and IBM says it will support the "emerging American Basic national standard." The S/38 model eight will be available in July with prices ranging from $160,000 to $252,000.

• HONEYWELL ENTERS MICRO WORLD. Taking a markedly different tack than its many rivals, Honeywell's Microsystem 6/10 is a scaled down, one-chip version of its DPS 6 minis. As such, the machine supports the entire base of GCOS software as well as Honeywell's IBM SNA and bisynch communications. The strategy is to avoid the retail scene and focus on DDP applications, selling to large customers interested in building common applications at multiple sites. Honeywell becomes the first vendor to support the full instruction set of its large systems; DEC comes closest with its Professional to Vax line. An 8086 CP/M, MS/DOS option is also available ($895) as is a 20MB 8" fixed disk. The base price of dual diskette, 0.5MB system is $5,495. Shipments begin in June.

• XEROX TEAMS UP WITH SPECTRA PHYSICS. The two companies will form a joint venture, Spectra Diode Laboratories, which will develop, manufacture, and market advanced semiconductor laser devices, light-emitting diodes, and a variety of device subsystems. The company will license technology developed at Xerox's Palo Alto Research Center (Parc), hoping to capitalize on Spectra's component marketing and management expertise. According to Spectra, the new Xerox technology is capable of producing semiconductor lasers 60 times more powerful than those in today's commercial market. Among the applications are laser printers, fiber optic transmission, and optical disk systems.

• BURROUGHS SHUTS DOWN DISPLAY DIVISION. Saying that the merchant components business is not compatible with its long-term strategy, Burroughs will phase out its Plainfield, NJ, operation. The division currently employs 400 people; some will move to other facilities, others will be layed off. Burroughs used the occasion to note that it is continuing to develop its full page, flat panel technology, known as the "Self-Scan with Memory," which it says will offer a competitive alternative to CRT tubes.

• CDC TAKES OVER ARBAT. The UK systems house has been taken over for about 8 million pounds, following CDC's purchase of a major share of Systime. Arbat has annual revenues of about 20 million pounds. In recent months, the UK's Compeda, Quest, and CIS have also been scooped up by foreign interests.

• IBM INTRODUCES THIRD ROBOT. The new 7540 falls between the two earlier machines, and, like the entry level 7535, it can be programmed by the IBM PC in IBM's AML language. The $37,000 robot is designed for assembly, materials handling and other high-precision work. Deliveries start in the third quarter.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR MAR. 31, 1983 o V/18, NO/23 P.J. MCGOVERN, PUBLISHER

DEC strengthens Japan operations -- Page 4

INDEPENDENT DISK MAKERS RAMP UP TO MEET PERSONAL COMPUTER BOOM AS STORAGE COSTS CONTINUE TO PLUMMET

Given the availability of cheap computing power, low-cost storage and output devices are shaping up as the key factors in using the elasticity factor to maintain the boom in personal computing sales.

Although "magnetic media valley" hasn't a prayer of replacing the Silicon Valley moniker, the disk business is proving to be equally sophisticated, fast-moving and lucrative. In fact, at a recent IEEE meeting, a spokesman for IBM's Magnetic Recording Institute estimated that Santa Clara valley shipments of magnetic and semiconductor products are roughly equal.

At last count there were more than 40 vendors vying for a share of the 5.25" Winchester market, and another 25 or so hoping to get in on the sub-5.25" floppy action. With well over 2 million PCs expected to be shipped in the U.S. this year, both sets of vendors expect that scale economies and learning curves will substantially improve today's price/performance levels. Among some of the recent developments in the low-end of today's disk market:

- The Japanese look much tougher in floppies than in the 5.25" Winchester market, where the U.S. seems to have at least a one year lead.
- IBM's blessing of the desktop computer Winchester market in its PC XT signals another departure from its old tact of waiting for a market to prove itself before entering.
- Maxtor has announced a 140MB 5.25" Winchester, and Toshiba says it can make a 3MB, 3.5", one-sided floppy. Evotek says that its 5.25" thin film Winchester technology has the potential for 300MB units.
- Microfloppies will be standard for portable computers. There are now four proposed standards led by Sony/Shugart, Hitachi, Tabor, and IBM, but any meaningful standards will be determined by the market.
- Half-height drives have substantially increased user options and capacities, and have become a vendor requirement.

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The low-end disk market, how big?

In 1982, the worldwide market for floppy and 5.25" rigid drives accounted for only about 20% of the $8.1 billion worldwide disk market. But over the next few years, this figure will rise substantially. Evotek, a potential leader in thin film Winchesters, estimates that worldwide 5.25" Winchester shipments will grow at 50% per year through 1986 reaching 2.1 million units. Shugart estimates that the market for floppy drives will reach 8.2 million units a year by 1984, and Hitachi sees shipments of 3" microfloppies reaching one million drives per year in 1984, ballooning to four million in 1986.

Although 5.25" hard disks will find substantial application in minicomputers, small business systems and word processing systems, personal computers will be the key to building high volumes. International Data Corporation estimates that over one million desktops will be shipped to the business and professional market in 1983 and that this figure will reach 2.4 million by 1986.

Given the falling prices of hard disks and the advantages of 10-20MB capacity, hard disk sales will pick up considerably once the necessary software is in place. If one-third of the U.S. business users opt for a hard disk, U.S. hard disk shipments would be in the 300,000 range for 1983. At an OEM price of $600, this would translate to a $180 million OEM market for U.S. desktops alone. If 50% have hard disks by 1986, U.S. Winchester shipments will reach 1.2 million. EDP/IR believes that both the 2.4 million systems, and the 50% Winchester penetration level are conservative estimates, and thus Evotek's worldwide estimate of 2.1 million units in 1986 is not unreasonable.

If one believes vendor claims, shipments of 300,000 Winchester units in 1983 may be conservative. Seagate boasts that it is building 1,000 of these drives per day, and there are 40 other vendors at various stages of production.

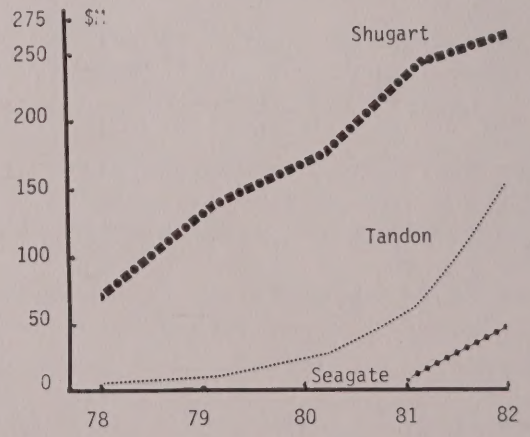
Taking advantage of elasticity

To some, the question is not how many hard disk drives will accompany the sales of personal computers, but rather how many personal computers can be sold if 20MB of storage can be had for $300-400. Standalone word processors and bit-mapped graphics applications are particularly storage sensitive.

In 1973, IBM's 3340 offered 70MB of disk for about $20,000. 70MB will soon be available for $2,000, a 10-fold improvement over 11 years (19% per year), almost matching the CPU's progress. Lower costs translate into higher volumes.

But as the chart opposite shows, the major small disk companies are still relatively small, causing some to question whether these companies can expand fast enough to meet their own projections. System vendors are not ready to be major suppliers and thus if the independents can't ramp up, production binds could occur.

REVENUES, LEADING SMALL DISK MAKERS



Note: Tandon's and Seagate's fiscal years end in June.

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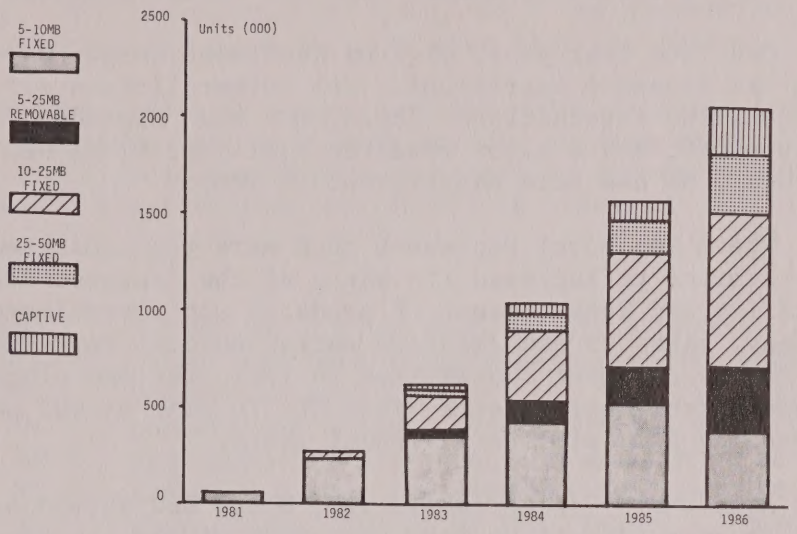
WORLDWIDE SHIPMENTS OF 5.25" RIGID DRIVES
(Source Evotek)



Evotek expects that 10-25MB drives will start to dominate in the 1984-85 period. Removable drives will catch on about the same time. The captive market will not be a significant force until 1986.

IBM's decision to offer a 10MB Winchester on its PC, is already causing some vendors to consider changing plans to offer 5MB disks. Once users get beyond 10MB, floppy backup starts getting unrealistic, even with 1MB floppies. Back-up alternatives include floppies, tape, removable drives, and optical disks. But at this time, system vendors do not seem very concerned with backup requirements, and it will be a while before the market determines its needs.

Sub-5.25" standards battle

For a while it looked like the industry might avoid a civil war over sub-5" floppy drives. But over the last few months, what was once two formats has grown to four, with major vendors entrenched in each group. The likelihood of a single standard has diminished significantly.

Each group has its own size, 3", 3.25", 3.5", and 3.9" respectively. IBM is the only vendor supporting the 3.9" format and seems to have missed the mark. It is doubtful whether even Big Blue's resources and market clout will be able to gather any momentum for a product which does not currently support standard interfaces, uses old technology and has less capacity than its rivals. Since IBM's PC group can pick and choose its own components, it is quite possible that even IBM won't make significant use of it.

In the U.S., the key debate is between the 3.25" and 3.5" formats. The former is supported almost exclusively by Dysan affiliates Tabor and Seagate; the latter group is headed by Sony, Shugart and many others. Both products support standard interfaces so there will be no need to change the controller software, and both offer similar capacities. The key difference is in packaging. The Shugart group uses a hard plastic shell and protected media, while the Tabor product is basically a smaller version of today's 5.25" floppy. The 3" format, which has substantial Japanese backing (see EDP/IR Vol. 18, No 22), also uses a hard shell and supports standard formats and capacities.

All three camps seem to have lined up substantial manufacturing resources and no one shows signs of budging. The Sony-type drive is a more sophisticated approach and has the momentum, but the Tabor style is the more proven method.

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DEC EXPANDS INTERESTS IN JAPAN; JAPANESE SUPERMINI MARKET REMAINS STRONG

As a follow-up to the story on Digital Equipment Corp. (Vol. 18, No. 21), EDP/IR offers an update from its sister publication, EDP/Japan Report.

Over the last year, Digital Equipment Corp. has made two official changes in its Japanese operations. The former liaison office, Digital Equipment Coporation International Japan, has been upgraded to a fully-owned subsidiary, Nihon DEC, and a major research facility, Nihon DEC Research and Development Center, KK has been established in Tokyo.

These two moves represent much more than just new name plates. DEC is determined to increase its share of the Japanese market, as well as better utilize and keep abreast of products and technologies emanating from Japan. Today, sales to the Japanese market account for a little more than 2% of DEC's revenues or about $80 million in 1982, but DEC plans to increase this share considerably and expects Nihon DEC to grow at 40% per year through 1985 reaching $200 million in annual sales.

As a wholly-owned subsidiary, Nihon DEC should have more flexibility to restructure itself to meet the needs of the Japanese market. It has recently hired former NCR Japan executive director Masanobu Watanabe as the company's first native director. A primary task will be to reorganize the DEC sales force away from a product line specialization towards something that better serves particular customer bases, probably according to company size rather than specific industries.

The R&D center may turn out to be even more important. DEC has lots of facilities throughout the world, but the Tokyo effort is expected to be on a scale with DEC's European Engineering group in Reading, England. Over the next three or four years, DEC expects to staff about 100 engineers, with the group concentrating on three main areas -- storage systems, terminals, and semiconductors. The center will also be responsible for developing kanji-based systems for the Japanese market.

In addition to these responsibilities, the R&D group is chartered to procure and evaluate components, subassemblies, and systems from other vendors. Such procurements are, of course, not new, but EDP/IR expects the pace to pick up. It is estimated that DEC's procurement of Japanese products roughly equals its sales to the Japanese market, or about $80 million.

Expanded training operations are further evidence of DEC's new commitment to the Japanese market. In 1981, DEC set up an educational services division with centers in Tokyo and Osaka. According to DEC, several multibillion dollar Japanese companies have plans to send over 100 employees to DEC to learn its version of Basic, and DEC expects its educational services business to grow 40% per year through 1988.

Within the next five years, DEC is expected to set up an advanced semiconductor and computer logic facility in Japan. IBM is also believed to have a similar plan to build a joint facility with NTT and Mitsubishi. In Japan, there is now a growing recognition that training and other forms of value-added service will be increasingly necessary to maintain sales, as hardware becomes more of a commodity and prices continue to fall.

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DEC enjoyed a public relations coup when the Institute for New Generation Computer Technology (ICOT) chose the DEC System 20 Model 60 as the main research computer for its fifth generation research project. The /20 was chosen because of its ability to run Prolog. Although there are only about a dozen users of /20s in Japan, several major Japanese companies that are part of ICOT are reportedly ready to buy. DEC is expected to bring out a new generation of mainframes this year. Apparently, the Japanese like what they see coming.

DEC is the supermini industry leader in Japan, but the major Japanese companies have been improving themselves and have been rapidly gaining share (see chart below). As for PCs, DEC's Kanji capability is scheduled for early 1984; the company hopes to ship 4,000 PCs this year and 20,000 in 1984.

UNIT SHIPMENTS OF 32-BIT MINIS

	1981	1982
Nihon DEC	75	215
NEC	61	200
Toshiba	70	185
Hitachi	21	90
Mitsubishi	50	80
Nippon DG	9	65
Others	83	100
Total	369	935

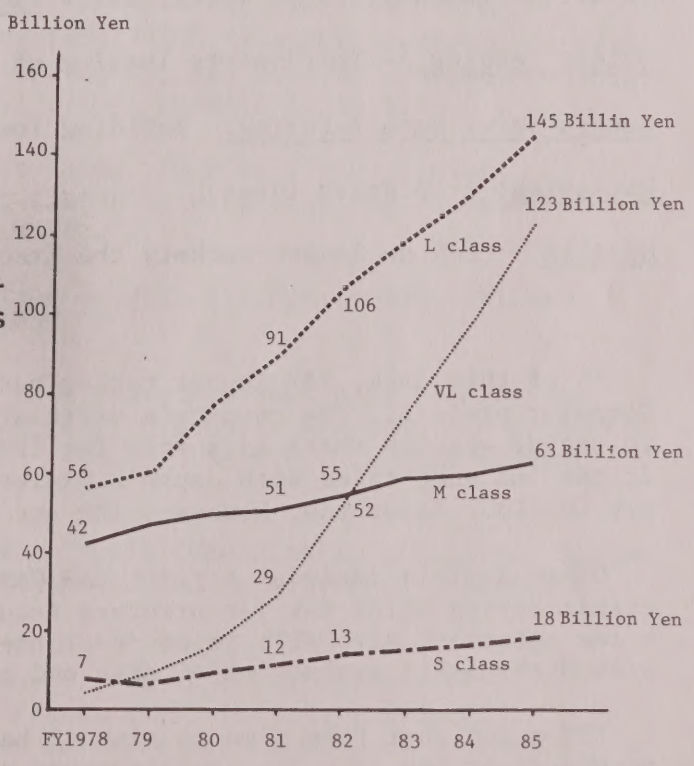
Unlike the U.S. market, 32-bit supermini sales have been largely restricted to non-commercial applications, and there is little competition between superminis and small general purpose mainframes. A weak third party software market and incompatible Japanese architectures are two of the reasons. There are signs, however, that these patterns are changing and DEC, DG, and HP hope to sell their minis as department-level systems.

JEIDA forecasts 1986 mini shipments of about $1.5 billion dollars, up from $817 million in 1981. In contrast, IDC estimates that mini sales in the U.S. were $5.0 billion in 1981 and will reach $12.7 billion by 1986, (EDP/IR, Vol. 18, No. 10).

DEC's sales are heavily weighted to the high and low ends. Over 50% of DEC's unit sales fall into the S class, and 22% fall into the VL category. As for applications, DEC minis are now used primarily in industrial automation, research, communications and network control, and data analysis, but commercial DP is expected to increase its current 6% share. Software availability gives DEC a key edge in many markets.

Notes: Defining the chart's categories by DEC's products -- L refers to large 16-bit minis, PDP-11/70 type; VL is for 32-bit Vaxs; M is for 11/34s; and S is for LSI 11s. Even given these steep growth rates, the Japanese market will remain much smaller than that in the U.S.

VALUE OF SHIPMENTS, JAPANESE MINI MARKET



Source: Japan Electronic Industry Association (JEIDA)

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IBM's Japanese ties

It's no secret that IBM has been actively pursuing talks with Japanese products and has already made a number of agreements. The pace of activity has led to a lot of rumor reporting. Over the past six months, EDP/IR has run across reports of IBM ties with 15 different Japanese companies for a wide array of products. We recently presented this list to IBM and received the following confirmations and denials.

CONFIRMED

Matsushita -- Supplies display tube for 3101s in Japan. Continuing talks toward joint venture of high volume products.

Toshiba -- Subassemblies for scanner and printer in IBM's Scanmaster.

Kanematsu Gosho -- Marketing of low-end products, Displaywriters, S/23, PCs.

Epson -- Matrix printer for PC.

Hitachi — IBM 3200 laser printer, built to IBM specs.

Oki Electric -- IBM 3283 printer (Model 53, Kanji version) built to IBM specs.

Tokyo Electric -- Printers for IBM 4700 banking system.

Nippon Telephone and Telegraph -- Patent cross licensing and technical information exchange, but not manufacturing know-how. Fiber optics, cable TV, and satellite communications specifically excluded.

Orient Leasing — Third-party leasing of IBM mainframes.

Sangyo Seiki Manufacturing. Building low-end robot to IBM specifications.

Mitsubishi -- Display tubes.

Minolta -- IBM no longer markets the Executive Copier 102, made by Minolta.

DENIED

As of this date, IBM is not taking part in the Japanese Fifth Generation Computer project. The company's official position is that it is still trying to decide whether there is a role for IBM in the project, and it reports that it has had some talks with Japan's Ministry of International Trade and Industry (MITI). As of now, however, IBM has neither asked nor been asked to join.

Other denials include: a joint CAD/CAM software project with Omron Tateishi; buying color ink jet printers from Sanyo; buying displays from Hitachi; a fax agreement with NTT; joint development of data communications products with Mitsubishi; evaluation of disk and printer products from Fujitsu.

IBM noted that from time to time it has had talks with just about every manufacturer around. The denials above mean merely that no agreement has been reached; there is no indication whether specific talks have occurred or not, and thus some of the above speculations could still turn out to be accurate.

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Where IBM's work gets done

Perhaps as much as any company in an industry, IBM is an integrated multinational organization with some 35 major manufacturing and development efforts in 14 nations outside of the U.S. At the end of 1981, IBM employed 103,500 workers in Europe, the Middle East, and Africa. In the Americas and the Far East it employs 45,000 workers, and its U.S. work force is approximately 200,000. Below is a brief list of what gets done where, as of December 1981.

JAPAN: Yasu plant -- large and intermediate processors; circuit packaging; substrate manufacturing and module assembly. Fujisawa plant -- disk files and controllers; distributed processors; communications terminals; multiplexors; industry-specific systems; printers; and tape drives.

GERMANY: Berlin -- disk drives (3350, 3370, 3380). Hanover -- power supplies; memory modules; and memory card assemblies; 4341s. Mainz -- disks and heads. Sindelfingen -- component manufacturing (memory devices, modules and substrates); packaging technology (cards and boards).

FRANCE: Boigny -- magnetic heads; logic chip module assemblies; supplies. Bordeaux -- communications systems (1750, 3750) and modems, circuit packaging assemblies. European component procurement. Corbeil-Essonnes -- logic and bipolar memory; component application development. Montpelier -- Large systems (3081s), channels (3814), tape/disk magnetic heads.

ITALY: Vimercate and Santa Palomba -- small systems (S/34, S/38, S/1); Displaywriters; point of sale systems; printers; terminals; circuit packaging assemblies; small disk drives.

UNITED KINGDOM: Greenock -- display systems; 4700 financial systems; circuit packaging assemblies; power supplies; keyboards; gas panels. Havant -- 4331s; 8100s; banking terminals; multiplexors; 3310s; ceramic substrates.

CANADA: Don Mills -- data collection systems; terminals and printers. Bromont -- single element typewriters; substrate manufacturing; module assembly card transports for magnetic media.

SPAIN: Valencia -- 3410, 3420, 8809 tape drives; finance communications controllers; large system power units.

SOUTH AND CENTRAL AMERICA: Brazil -- intermediate processors; disk files; displays; controllers; printers; typewriters; ribbons. Argentina -- printers. Colombia -- single element typewriters; ribbons. Mexico -- single element typewriters; typebar typewriters; and ribbons.

EUROPE AND FAR EAST: Netherlands -- electronic typewriters, printers. Sweden -- small, intermediate and high-end printers; 3880 controllers. Australia -- single element typewriters.

In addition, IBM has major development facilities in Germany (4300, banking systems, data base software); France (VLSI logic and memory, telecommunica- tions); England (lots of software and display technology); Sweden (process and manufacturing systems); Italy (software); Switzerland (advanced solid state physics); Canada (program development); and Japan (communication products, language research, image processing and CAD).

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• GENE AMDAHL SPEAKS OF NEW SYSTEMS. At a March speech at DEC's computing museum in Marlboro, MA, Trilogy founder Gene Amdahl reaffirmed that he expects his company's IBM-compatible CPUs to be "more than twice as fast as any other technology we expect to be available in about two years when ours comes out." It will use the "biggest chips in the world." If the systems do come out in March 1985, they will be only a few months late; the company had previously been talking about a late 1984 introduction.

• HONEYWELL REORGANIZES, AGAIN. Effectively undoing some of the changes made last year, Honeywell is merging its Billerica, MA, office automation and small systems group into the Office Management Systems Division which will have responsibility for the DPS 6 line, as well as Honeywell's office and future personal computing products.

Also created is the Manufacturing Systems Division and the Application System Division. The former will be based in Phoenix and concentrate on integrated manufacturing systems; the latter will work out of Minneapolis and offer custom software and hardware to markets not served by the other two divisions. An interesting wrinkle is that the Large Information Systems Division in Phoenix has been renamed the Large Computer Products Division, and the shift from "systems" to "products" is bound to raise a few eyebrows among those who question the company's mainframe future. The moves are the first major changes since James Renier took over.

• IBM HEADS BACK TO THE COURTS. In what is becoming a familiar refrain, IBM is filing charges of trade secret thefts against Cybernex, an IBM spin-off that manufactures thin film heads. Cybernex is one of just three companies selling thin film heads on the OEM market, the others being Magnex and Peripheral Components, the Burroughs, Memorex, and CDC joint venture. IBM contends that given Cybernex's limited budget it could not possibly develop thin film heads without using secrets learned while at IBM. Since the highly-publicized Hitachi/Mitsubishi sting, IBM has also filed charges against NCR Comten, and some former PC employees. Per usual, Cybernex denies any wrongdoing.

• GEISCO UNITES SOFTWARE GROUPS. The Systems Development and Consulting operation (SDC) and the LTI Consulting Services group have been merged into a wholly-owned Geisco subsidiary called General Electric Professional Services Company. In total, SDC and LTI had 1982 revenues of $80 million; Geisco's 1982 revenues were more than $600 million.

• NBI BRINGS WP SOFTWARE TO IBM PC. Recognizing that word processing is really an application software market, NBI is offering its WP software to IBM PC and Compaq portable computer users. For $695, NBI claims that the user can get WP system functionality and documentation as well as document interchangeability with NBI's WP systems. NBI reports that Storage Technology, Upjohn, Battelle, and Fireman's Fund have already ordered the software.

• NEW ENTRY-LEVEL MAINFRAME FROM BURROUGHS. The new 2925 boasts 1.3 times the power of the older 2800 systems in just 40% of the space. Up to 2MB of memory is available. Like other Burroughs mainframes, the 2925 has a separate I/O processor. A shared system processor allows multiple hosts to share common files. The 2925 is available this quarter with prices starting at $145,000.

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IBM shows new PC, terminals, 3725 -- Page 5

NCR LOOKS TO 32-BIT CHIP TO PULL OUT OF DOLDRUMS; NEW PRODUCTS REFLECT UNUSUAL STRATEGIES

NCR's own data shows that in real dollar terms the company has been shrinking at about 2.3% per year since 1978. Its industry-specific strategy has left it with a sluggish customer base, and its failure to enter emerging new markets has given the company a less than glamorous image.

Pulling out of the tailspin will require some doing, but change is underway. The company is adopting widespread product, marketing, and philosophical reforms based on a market outlook different from many of its competitors. But the key factor is NCR's new 32-bit microprocessor which holds the potential for considerable product line revitalization over the next few years. Wall Street seems to agree, bidding NCR's stock from 40 to 109 over the last twelve months.

The new 9300 series is only the first product to use the NCR/32. The 8500 mainframe series will follow as will NCR Comten's next generation of front-end equipment. In fact, NCR claims the /32 with its "soft architecture" is so versatile that it can run IBM 370 instructions without loss of performance, although the company is quick to say that it has no intention of getting into the PCM CPU business. The gist of NCR's new direction is summarized below:

- Marketing. NCR is going away from an industry-specific strategy towards a product orientation, less concerned with solutions, and more with good tools and aggressive price/performance iron.

- Software bases. Rather than developing an integrated product line, NCR is concentrating on targeting existing software bases. In addition to its 9000 and 8500 families, the Tower targets Unix, its Mentor systems aim at Pick, and its desktop the CP/M and MS/DOS base.

- Multiprocessing (MP). The company feels that MP technology is more suited to the transaction processing environments it serves than large mainframes, and the NCR/32 is well suited to MP tasks.

- Industry standards. The Tower 1632, being sold direct and to OEMs, uses industry standard software and interfaces, a first for NCR.

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The new NCR/32

If NCR is to turn its fortunes around, its new 32-bit microprocessor will have to live up to its publicity. It will be the key to both the 9000 and 8500 series lines, and is instrumental in the multiprocessing, redundant, bus-oriented path the company says it has chosen to follow.

If nothing else, the /32 has allowed for some significant packaging improvements. NCR claims that the new 9300 machine has the power of the 9040 introduced just two years ago, but has only 1/8th the weight, and requires just 1/10th the power. Coupled with 64K RAMs, NCR can put .3 MIPs and 4MB memory (on just two boards) into a 25"x17"x7" box.

Although NCR's MIP rating may appear to be low, an NCR spokesman pointed out that "there are big MIPs and little MIPs, and these are big MIPs." The point is that mainframes such as the 9300 or IBM 4300 have more powerful instruction sets than some of their supermini rivals, and thus the MIP ratings tossed around for the two types of machines are not always comparable.

The spokesman also noted that although the processor chip contains 70,000 devices, the densities and hence the power can be increased by at least a factor of two by using known technologies. In particular, the three micron NMOS silicide geometries can be taken down to 1.5 microns.

Architecturally, NCR describes the /32 as a soft architecture. The microprocessor employs a firmware set of 160 microcode instructions which reside in separate ROM or RAM chips. The effect is that the system can be configured to emulate different machines without having to touch the processor logic itself. NCR says that the architecture is patterned after the RISC (Reduced Instruction Set Computer) philosophy (see EDP/IR, Vol. 18, No. 3, page 4).

The ability to run a 370 instruction set is bound to raise a few eyebrows. NCR says that this can be done without performance loss and points to Comten which will be using the /32 to run 370-like instructions in its next generation of front ends to be announced soon. NCR says that the 370 capability has attracted a lot of attention from OEMs, but that NCR will not enter the PCM CPU business because it doesn't believe it could make enough money in it.

OEM sampling of the /32 will begin in the second quarter and a board level version will also become available. NCR says that it does not expect to sell the chip to its large company rivals. More likely, demand for the /32 will come from small companies hoping to target a specific niche quickly with high price/performance and from larger companies hoping to enter new markets. Xerox and several Japanese companies are said to be particularly interested.

As for the 9300, it will be fully source and object code compatible with the rest of the 9000 series. A sample configuration with a CPU with 1MB memory, seven communications lines and firmware ($22,295); an 81MB disk ($19,800); 360 lpm printer ($9,100); ITX operating system, utilities, and cobol compiler ($3,440); and six terminals ($5,100) totals to $59,735.

NCR sees the 9300 competing primarily against IBM S/34 and S/38, Burroughs B-920, Vax 11/730, and the HP 3000-33, -40. The system will be manufactured at NCR's San Diego facility and volume shipments will begin in June. Thus far at least, there are no plans to market the 9300 to OEMs.

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Marketing strategies

Just about every major vendor in the industry has attempted some sort of marketing reorganization within the last two years. Most of the action has centered around developing integrated product lines and presenting a single face to the customer. NCR, however, has adopted only the second part of this.

The company does not believe that it is sufficient or even necessary to build a desktop-to-supermini uniform architecture. Rather, NCR has preferred to build several different families of products aimed at specific software markets. Thus there is some overlap but little compatibility between its Convergent Technologies-based Worksaver, the 9300, the 8500, and the Tower 1632, while its DecisionMate personal computer is not intimately tied to any of the above. Communications links are, however, generally available.

The Tower is perhaps the best illustration of NCR's novel approach. With its emphasis on high price/performance and standard peripheral interfaces, the Tower appears to be a useful box for the OEM interested in the Unix-based, PDP-11 type market. But NCR also plans to sell the Tower direct, not as an application machine, but as a tool that the MIS department can buy, configure and add application software to. This is the traditional mini vendor approach.

The strategy is unusual because while NCR is pushing high performance, general purpose iron to the MIS department, the major mini vendors are rapidly moving away from these roots toward increased handholding and "information solutions" sold to end users. Neither the Tower nor the 9300 have much to say on the subjects of office automation, personal workstations, or hybrid systems.

NCR's rationale is that the vast majority of the market still buys a system for a single application and that the compromises built into the hybrid DP/WP systems available today leave them unattractive to most users. It also believes that the much talked about on-line access to corporate data is still a long way off. Suffice to say that if NCR is right, a lot of people are wrong.

These strategies reflect a clear shift in marketing emphasis. NCR's historical emphasis on retail, banking, and small-scale manufacturing has left it with a relatively low profile in the Fortune 1000. Because it has never really been able to go after the high-end user, NCR is not dealing from the data center position of its traditional competitors. Indeed, in many respects NCR is not a mainframe company at all, but rather a large supermini vendor; this is why SNA support is so important to the company.

Management has decided that if it is to achieve the growth necessary to fund continued product improvement, it must expand its customer base to include more large users. It has chosen to pursue the big customer by emphasizing general purpose tools, not industry-specific solutions. The key link with the past will be a continued emphasis on transaction processing (TP).

NCR sees TP systems evolving along multiprocessor lines for both performance and redundancy reasons. It also believes the future of these systems lies with MOS technology which, because of its relatively slow speeds, is not suited to mainframe requirements. NCR will follow the path of Tandem in building modular, shared resource systems linked by a high-speed bus, with SNA gateways to IBM. For NCR, the tools, the software and hardware price/performance are shaping up, but the marketing strategy has yet to be tested.

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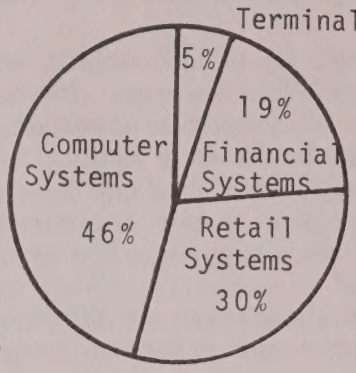
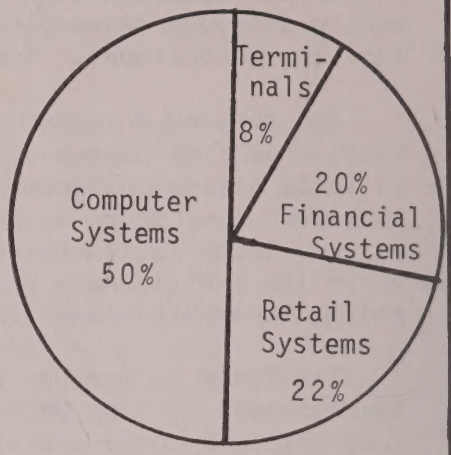
NCR WORLDWIDE EQUIPMENT REVENUES, 1978-1982
(Source: NCR)

Note the falling share of retail systems and the rise of computers and terminals. The company sees this trend continuing for the future as the sale of OEM products picks up. The terminal data reflects the purchase of ADDs in 1980.



1978
$1,509 Million



1982
$2,086 Million

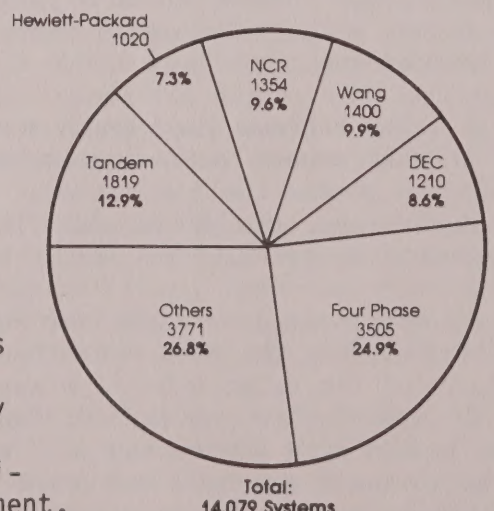
NCR round-up

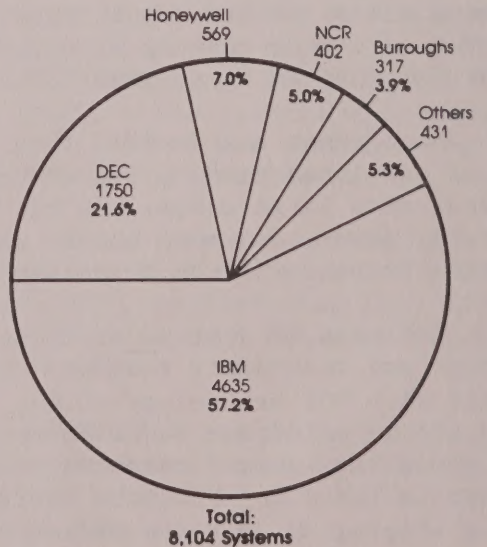
Although the CP/M or MS/DOS-based DecisionMate is clearly a "me too" PC whose late entry will make it difficult to generate a lot of dealer momentum, the machine does have some nice features. The packaging is slick, the dual diskette drives sit beside the screen, and thus the system footprint is considerably less than most of today's popular models. An NEC graphics chip is standard, and the price for a configured system maps right onto the new IBM PC prices. In addition, in cooperation with Corvus, NCR can offer local networking capabilities featuring electronic mail, and shared disks and printers.

On a more experimental note, NCR has quietly introduced a product called Modus, designed to link CP/M and MP/M personal computers of different manufacturers and, given certain operating system constraints, allow them to share both disk and files, an ambitious attempt to tackle the compatibility issue.

MARKET SHARES 1981 WORLDWIDE SHIPMENTS, SYSTEMS $81K-150K (left)
AND $250K-500K (right) -- Copyright 1983, IDC

Prices based on Average System Values as estimated by IDC. They include all attached peripheral equipment.





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IBM ROLLS OUT NEW TERMINALS, CONTROLLERS, AND PC, BUT MARKET IMPACT LIMITED

The general reaction was one of disappointment. IBM's latest wave of product announcements does not substantially change the computing options previously available. The systems do, however, improve price/performance levels, put a squeeze on the competition and give some strong hints of future directions.

IBM devoted its entire press conference to its new PC, the IBM XT, which is little more than the old PC packaged with a 10MB Winchester disk. The new 3178 terminal is a smaller, less expensive, limited function version of the popular 3278, while the new 3725 controller falls into the bigger, faster, more reliable category. The only really new capabilities came with the 3290 gas panel display, and the option to upgrade 3278s to PC status.

Nevertheless, the announcements are significant for a number of reasons. IBM has suddenly become a price/performance leader in hard disk PCs, putting pressure on companies such as DEC, Victor, and Vector Graphic. Independent terminal manufacturers have taken some 50% of the 3270 market, and the new pricing levels, about 25% lower, will bite into the independent's margins and probably increase IBM's share. 3705 competitors have historically had less success, but are not terribly worried about the new 3725 which has cleared the air so that Comten, Memorex, CCI, and the like no longer have to compete with what IBM "might" offer. Some other points of note:

- With the XT, for the first time IBM is bringing its Information Network into the game as an "electronic brochure" to demonstrate software and to handle library reference functions.

- The new 3178 features a one-shot five-year maintenance charge of $250, on a customer carry-in basis. The new terminals, controllers, and front ends will be available on lease through IBM Credit Corp.

- Although the price is high, 3278s can now be upgraded to PCs, and IBM is talking about the need to download information from the host.

- Unlike past terminal announcements, the 3178 is available on ten-day delivery. Volume discounts go from 9% to 40%.

- The gas panel display was announced last December as an OEM product. (See EDP/IR, Vol. 18, No. 17, page 8.) Flat panel activity has picked up, but will remain a niche market for the next five years.

Clearly, IBM's $7,000 XT price (including color graphics, 10MB Winchester, and a printer) will have major impact on the pricing strategies of desktop vendors considering hard disk attachments. It will also bring in profits to IBM which otherwise would have gone to independents. IBM also slashed prices by 12%-15% on the old PC (whose sales are still booming), bringing it into line with the systems recently announced by Texas Instruments and others.

Less aggressively priced is the 3278-to-PC conversion kit. Following the path of DEC, Univac and several 3270-type vendors, IBM is allowing its 3278s to be upgraded to PCs using the 3278's keyboard and display. Although there are certainly many 3278 users who would want this feature, the $3,000 to $4,000 upgrade price is likely to slow down the rush. DEC charges $2,400.

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Although there is now some overlap, EDP/IR believes that for the vast majority of applications, the user will know whether he wants a 3270 or a PC; their strengths and weaknesses are easily identifiable. Thus, despite a potential market of over 600,000 IBM 3270 terminals in the U.S. (as of 12/81), the actual number of users that convert may well be less important than the clear direction the announcement heralds. In IBM's words:

> *"In host compute mode, the alphanumeric data visible on the 3278 screen can be captured as IBM PC Ascii data on the PC printer or diskette ... a user may request files to be transferred between VM/SP (CMS) or TSO systems and the IBM 3270 personal computer."*

The Winchester option also suggests that IBM is serious about downloading host files for local processing, but transfer of PC files to the host is another matter. IBM says: "transfer between the IBM PC and host systems that support structured fields requires user-written programs at the host and the PC."

The new terminals

The two new terminals should help alleviate two pressing IBM problems: IBM's declining share of its own terminal base and its lack of a sophisticated display for scientific/engineering applications. Over the course of the 1977 to 1982 period, IBM watched its share of the 3270 base fall from about 80% to 50%, as a score of independents managed to undercut IBM's 3270 prices.

The new 3178 is basically a stripped down $1,700 version of the 3278, and thus both products will coexist for a while. EDP/IR expects that over time the 3178 will take on many 3278 functions and eventually become the mainline tube. If IBM can add functionality without substantially raising prices, it will gain market share and put considerable pressure on the margins of its PCM rivals. The new gas panel 3290 ($7,100) hints at the future and should help cut off would-be competitors at the pass, positioning IBM as a technology leader.

Finally, a new 37XX controller

For years IBM watchers have been expecting a replacement for the 11-year-old 3705, but IBM's lease base and its dominant market share gave Big Blue little incentive for change. This state of expectation frustrated the PCM competition, as customers waited to see what IBM would come out with. A Comten spokesman expressed relief that this air of uncertainty had finally passed.

The new 3725 is billed as a bigger and faster 3705 using LSI circuitry, but its new capacities do not pose an overwhelming threat to the competition. Maximum memory has been doubled to 1MB, as has the number of host system channels (to eight). The storage cycle time has been reduced from the 900 nanoseconds on the 3705, but IBM is not saying by how much. On a purchase basis, a user could buy one 3725 instead of two 3705s and save himself 15%.

Understating system price/performance at the time of announcement is a familiar IBM strategy. When the 3081D was announced, its price/performance was low enough to keep 3033U residual values from falling through the floor. A year later the 3081K came along with significantly improved price/performance. The high end 3725 Model 1 will begin shipments in the fourth quarter, while the low-end 3725 Model 2 starts first quarter 1984. Announcement of performance improvements or new features by the end of the year would not be surprising.

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PURCHASE/RENTAL RATIOS IBM 3278 and 3705, 1978-1983
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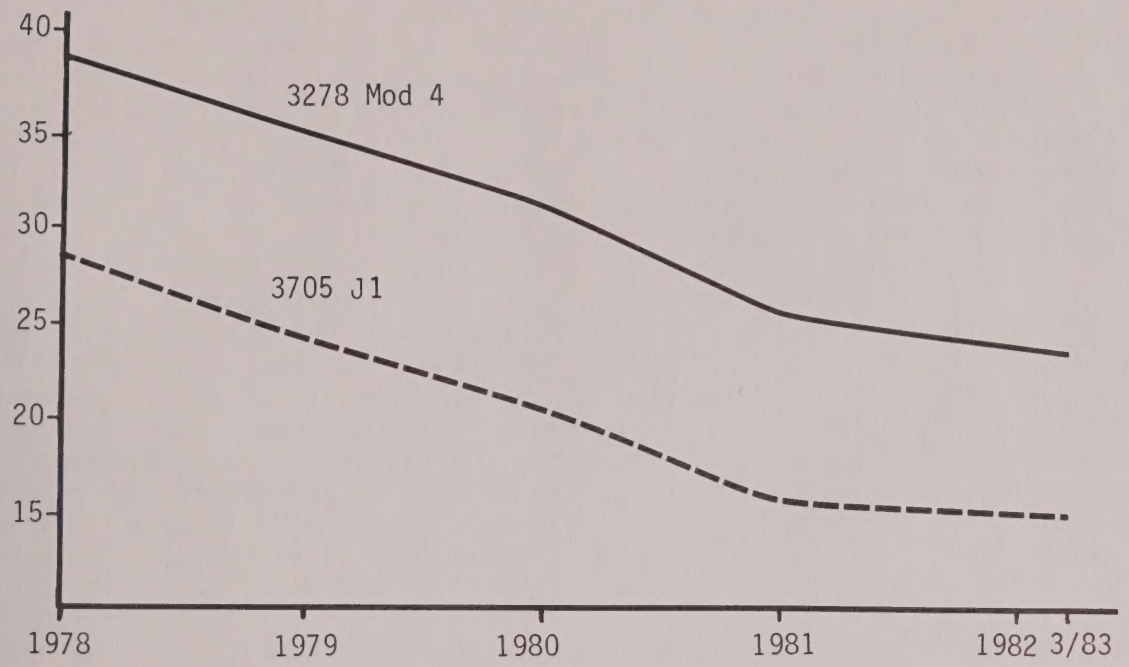

U.S DATA ENTRY TERMINAL MARKET, SHIPMENTS AND INSTALLED BASE, 1981
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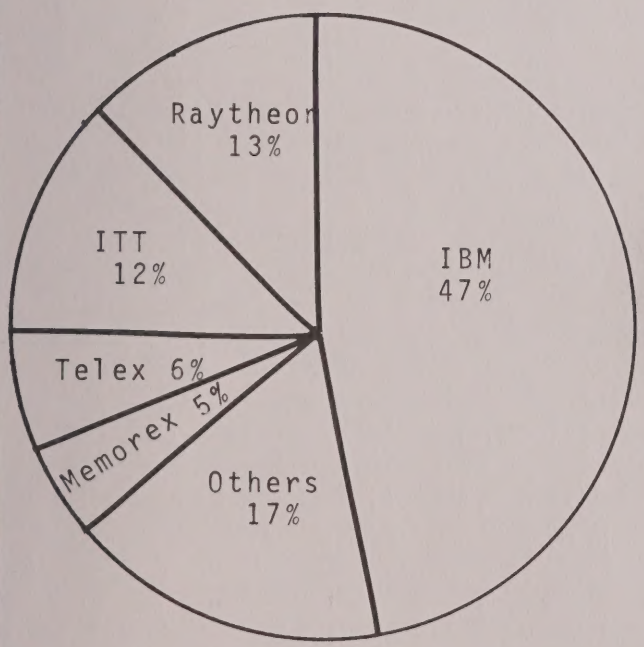
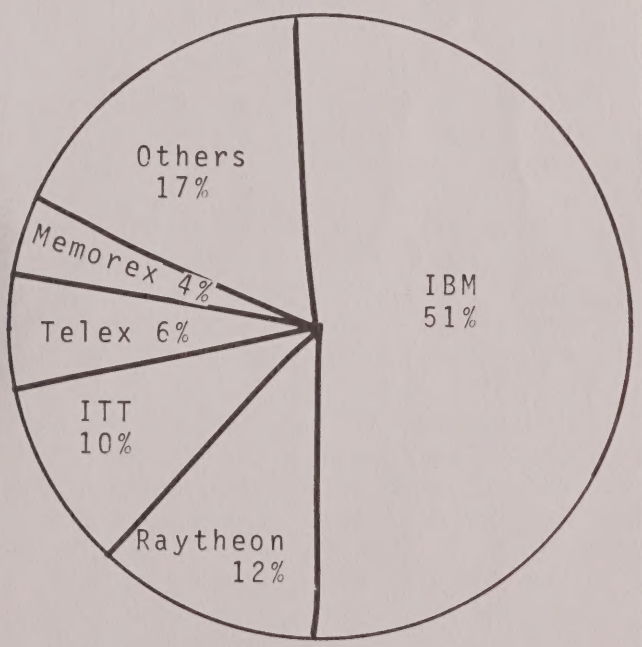


280,000 SHIPPED



1,200,000 INSTALLED

Others include: AT&T, Harris, Honeywell, Mohawk, Management Assistance Inc, Bunker Ramo, Northern Telecom, Computer Optics, GTE/IS, Paradyne, Four Phase, Lee Data, Racal Milgo, Codex, and Phone 1.

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• MAGNUSON FILES FOR CHAPTER 11. The long slide has reached rock bottom. Unless Magnuson can find someone to acquire it, it looks like another PCM will vanish. The combination of mismanagement and IBM price cuts has choked off the company's future, as the mid-range PCM market continues to be a very tough business. Among the mentioned buyers are Storage Technology, Burroughs, General Electric, and several Japanese companies and service bureaus. Sorbus will probably handle most of the service from now on.

• 17 COMPANIES ENDORSE 3" FLOPPY STANDARD. In a small victory in the sub-5.25" disk battle, Matsushita and Hitachi have convinced a band of minor Japanese players and several U.S. vendors to support its formats for 3" floppies. The fourteen Japanese companies are: Matushita Electric, Hitachi, Hitachi Maxell, Canon, Fuji Photo Film, Jicoh Electronics, Mitsumi Electric, Nippon Seimitsu Kogyo, Sankyo Seiki Manufacturing, Sanyo Electric, TDK Electronics, TEAC, Teijin, and Tokyo Electric. The three U.S. firms are Memorex, Micro Peripherals, and 3M. IBM has announced a 4" floppy, while Shugart and Sony are pushing for a 3.5" version. A third group, including Seagate, Tabor, and Dyson are supporting a 3.25" standard.

• NTT INVITES U.S. FIRMS TO BID FOR FIBER OPTIC CONTRACT. NTT is building two prototype fiber optic networks at its Atsugi Laboratory, one that transmits synchronous and asynchronous traffic at 100Mbits/second, and one that sends only asynchronous traffic at 32Mbits/sec. The telephone company is publicizing its efforts to obtain foreign technology and reports that in Japan's fiscal 1982 (April '82-March '83) American companies won contracts from NTT worth $34 million, a small total, but double that for 1981.

• HARRIS AND CRAY SIGN JOINT SEMI ACCORD. The two firms will explore the potential for Gallium Arsenide (GaAs) circuits in supercomputers. Harris' Microwave Semiconductor group already specializes in GaAs circuits for its communications systems. GaAs semis can be up to five times faster than silicon.

• UNIVAC SHOWS SEMICONDUCTOR STORAGE SYSTEM. Showing that it is serious about aggressively pushing high end performance, Univac now has three semiconductor storage systems geared to ultra-fast I/O. Operating as a large, high speed cache, Univac's Semiconductor Auxiliary Storage (SAS) can hold up to 14 million words of data with retrieval rates of less than one microsecond and transfer rates as fast as five Mbytes/second. Univac says that SAS is ideal for frequently used data such as rate tables, data base directories, critical executive files, dictionaries, and indices. The SAS unit can also sit between the host and disk files to hold recently requested data. The new products will be available in April with prices of $150,000-$200,000.

• TYMSHARE TO ACQUIRE INTERNATIONAL RECORD CARRIER. In an effort to get in on the international electronic messaging business, Tymshare has signed a formal purchase agreement to acquire FTC Communications, Inc., an International Record Carrier (IRC) with 1982 revenues of $12.2 million. Pending FCC approval, Tymshare will acquire an 80% interest, with a French Bank (Via Banque) retaining the remaining 20% share. Tymshare had a rough year in 1982, with revenues up just 3%, and earnings down 44%.

• IBM ADDS PC TO VAR PROGRAM. The emphasis is on vertical applications.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR FEB. 28, 1983 • V/18, NO/21 P.J. MCGOVERN, PUBLISHER

MINI VENDORS HIT TROUGH OF THE RECESSION; ADJUST STRATEGIES TO COPE WITH CHANGING MARKETPLACE

Perhaps the silver lining of any recession is that it provides time for management to firm up internal weak spots and prepare new products for the better times ahead. With minicomputer shipment activity uncharacteristically flat, key mini vendors such as Digital Equipment, Data General, and Hewlett-Packard hope to finish organizational overhauls before the next market upturn.

Part of the incentive to change has come from personal computers and part from the need to take more of an integrated systems approach. It's no secret that DEC is converting large chunks of its production lines over to personal computers, and the company plans to ship 50,000 desktops by June. The manufacturing and distribution resources required by these small systems are forcing major organizational reforms at DEC as well as its major mini competitors.

Rapid increases in microprocessor power have lead many to predict the demise of the traditional mini market, much as mini boosters attacked the mainframe world in the mid 1970s. Once again, such doomsaying seems unwarranted. EDP/IR believes that the demand for computing power will remain a relatively continuous function. The power of the mainframe is increasing almost as fast as that of the desktop, and minis should still be able to fill part of the wide gap in between. Some trends and events in the mini market in 1982:

- The recession has hit hard in the last six months, especially at DEC and Data General.
- Mini vendors are taking aim at the low-end with new 32-bit machines, witness DG's MV/4000, DEC's VAX 730, and Prime's 2250.
- As the market matures, upgrades, replacements and peripherals are becoming increasingly important. The market is slowly taking on more of the characteristics of the mainframe business.
- One blessing is that more than any other sector of this industry, the mini vendors don't have to look at a near-term threat from Japan.
- Distribution of low-end products remains tricky. DEC has decided to revamp its retail stores, and DG has shifted its dealer strategy.

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Mini vendors' strategies -- compatibility and distribution

In general, U.S. minicomputer vendors have done a good job of building compatible families of computers. And just as in the 1970s, when DEC and DG built broad lines of 16-bit machines, DEC, DG, and Prime now offer full lines of 32-bit power. The exceptions are HP, which doesn't have a 32-bit mini (it has a 32-bit desktop), and Wang whose OIS and VS systems have limited compatibility.

Over the last year, DEC, Prime, and DG have extended their 32-bit lines downward. The new systems offer a lead into the vendor's more powerful superminis and help compete with the microprocessor-based systems that are eating up large chunks of the low-end market. The three systems are priced in the $70,000 range and compare as follows:

Company	Model	Available	Price*	Max. Mem.	# Terminals
DEC	VAX 11/730	4Q/82	$59,400	5MB	24
DG	MV/4000	1Q/83	63,400	8MB	64
Prime	2250	1Q/83	78,000	4MB	32

* DEC's price includes 1MB memory, controller, 131MB disk, VMS software, and one terminal. DG's price includes: 1MB memory, 147MB disk, 1600 bpi tape drive, system console, and AOS/VS operating system. Prime's price includes: 1MB memory, 136MB disk, 4 terminals, 15MB tape drive, printer and controller.

The next part of the strategy is to bring minicomputer architecture and software down to the desktop level. This will help bring in needed new business, and is a natural offshoot of the mini vendors' cost-cutting efforts based on VLSI circuitry. DEC has made it clear that it intends to put the VAX on a chip in the not too distant future, and has several such plans in the works.

Not only does desktop-to-supermini compatibility provide a nice marketing angle, but it also helps to lock-in existing customers who can upgrade without having to junk existing software or learn new operating procedures. End users do not like to have to be retrained.

As the chart on the next page shows, DEC has done a good job of this with its personal computer, but the same cannot be said of its minicomputer competitors, whose micros are generally compatible only at the terminal level. Prime and Tandem don't even market personal computers. Rumors persist that IBM's Olympia series will bring a 4300-like architecture to the desktop world.

The competitive edge in having a smooth upgrade is shown by the difference between going from an IBM System/34 to a S/38 vs. from a PDP-11 to a VAX. IBM has not been very successful in migrating users from the /34 to the /38, and thus several firms are trying to cut out a share of the huge /34 base.

Sperry Univac has just announced software that helps System/34 users move to its System 80. It claims that, with a few exceptions, disks can be copied and programs merely recompiled. The System 80 family then offers the users a wide range of power. Wang's low-end VS 25 and 45, announced last May, also specifically target the S/34 base, promising conversion in weeks, not months.

Because their upgrades are relatively smooth, DEC and DG have had few such problems. Their biggest hurdle has been to develop enough 32-bit software to entice users to migrate from the older 16-bit machines.

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PRIMER ON DEC COMPATIBILITY

In terms of compatibility across a broad product line, DEC is way ahead of anything IBM can offer. Strong compatibility exists between the Professional Computer and the VAX/780, but breaks down at the mainframe DEC systems 10/20 level, and DEC has indicated that this status will continue. Compare this to what IBM has had to do to achieve minimal levels of compatibility between its Personal Computers, Displaywriters, 5520s, Series/1s, 8100s, S/38s, S/34s and 370-type machines. (See EDP/IR, Vol. 18, No. 16.). Below is how DEC sees the relative compatibility of its current products. As the data shows, the key desktop/supermini connection is between the Professional and the VAX.

DECMATE COMPATIBILITY WITH VAX

Same	Similar	Different
Keyboard	Training	Utilities
Command Lang.		File Struc.
File Exchange		Instr. Set
Menu		Languages
Interactive		

PROFESSIONAL COMPATIBILITY WITH VAX

Same	Similar	Different
Keyboard	Training	Comm. Lang.
Languages	Instr. Set	Menu
File Struc.		
File Exchange		
Utilities		
Interactive		

RAINBOW COMPATIBILITY WITH VAX

Same	Similar	Different
Keyboard		Command Lang.
Interactive		Languages
File Exchange		Utilities
		File Struc.
		Instr. Set
		Training

PDP 11 COMPATIBILITY WITH VAX

Same	Similar	Different
Keyboards	Comm. Lang.	
Interact.	Languages	
File Exch.	Utilities	
	File Structures	
	Instruction Set	
	Menu	
	Training	

DEC 10/20 COMPATIBILITY WITH VAX

Same	Similar	Different
Keyboards	Menu	Instr. Set
Interactive	Comm. Lang.	
File Exch.	Languages	
	Utilities	
	File Structures	
	Training	

Notes: DEC breaks compatibility into two areas. User Interface includes keyboards, command languages, languages, file structures, instruction sets, menus, utilities, and training. Communications includes interactive (VT100 emulation) and file exchange.

DEC has also become an avid booster of local area networks and is even using the phrase "the network is the computer." As part of its push toward shared resources, it has recently made a major announcement of shared processor and storage capabilities over a high-speed (70 megabits/sec.) bus. This function will allow users to incrementally increase processing and storage capacity and could yield considerable savings and flexibility for some users.

The "advanced system interconnect structure" is now offered only on the DEC System 20 mainframes, but DEC has said that such capabilities will eventually be offered on the PDP-11, VAX, and professional computer lines. Availability on the VAX will be particularly useful once DEC decides to fully compete in the fault-tolerant marketplace where Tandem offers similar features.

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Distribution strategies

Distribution issues continue to prove perplexing. Manufacturers' retail stores -- IBM, DEC, and Xerox -- have not done well and have created territorial conflicts and disputes over margins. DEC has decided to revamp its 24 retail outlets, removing its personal computers, and turning the stores into Digital Business Centers which will push Decmates, low end VAXs and PDP 11s to small businesses in need of advice and handholding. DEC's Professional and Rainbow computers will be sold through dealers and the DEC sales force which will sell to the Fortune 1000, governments, schools and other large accounts.

DEC says that it has over 200 dealers now and plans to have 600 by July. Independent dealers will purchase their machines from DEC's sole PC distributor, Hamilton Avnet. Questions of who gets what at what price will continue to be touchy, i.e., "does Hamilton Avnet get a lower price than Computerland? If it doesn't, how can independent dealers compete with Computerland?" DEC would not comment on its dealer/distributor pricing strategy.

(EDP/IR distinguishes between dealers and distributors as follows. A dealer sells mostly to end users through a retail-like environment. A distributor sells primarily to remarketers; if it sells to end users, it doesn't normally do it through a retail store operation.)

Similar reshuffling has occurred at Data General. It has decided to stop selling its Enterprise small business system through distributors and concentrate on building a dealer network, a decision that has left some hard feelings. DG does not believe that products in the $5,000 to $15,000 range can be successfully marketed by its traditional distributors and OEMs, but, thus far at least, retailers have not shown much interest in the Enterprise.

The situation at Hewlett-Packard is even more complicated. Up until recently, HP has had three groups responsible for personal computers. The Corvallis group made both the handheld computers and the HP 85s; the Computer Terminals Group made the HP 125; while the Technical Computer Group designed the new 32-bit HP 9000. As a rule, the three units did not work together, resulting in both overlapping efforts and conflicting market strategies. Additionally, HP's desktops haven't overcome their reputation for being engineering oriented.

Over the last six months, HP has been moving to coordinate and integrate its personal computer efforts from both a developmental and marketing perspective. The company has also just announced a major corporate reorganization plan to improve its overall product integration. Below is the new structure:

- Computer products group -- responsible for development and manufacture of CPUs, operating systems, languages and VLSI.
- Information products group -- development and manufacture of peripherals, datacom products, database resources, and system integration.
- Personal computer group -- responsible for all workstations, i.e., personal computers and terminals.
- Business development group -- market development strategies.
- Computer marketing group -- sales, maintenance, and support.

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DISTRIBUTION CHANNEL REVENUES, U.S. DESKTOP COMPUTERS
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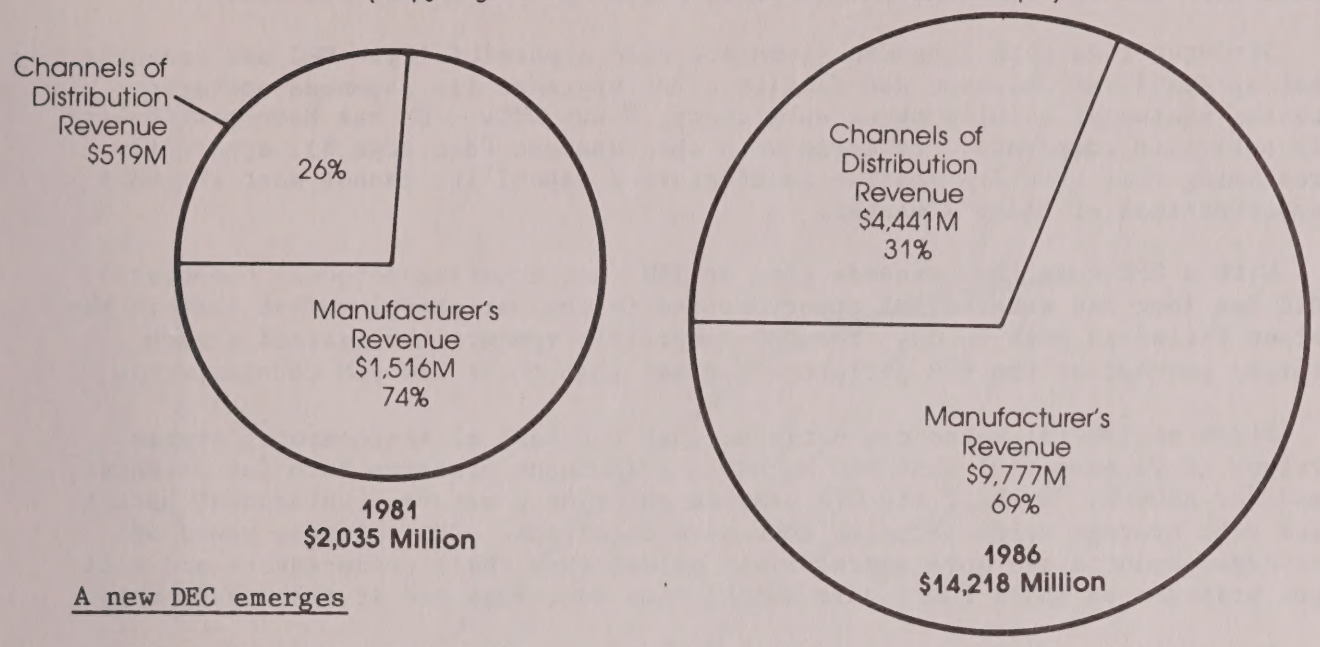

A new DEC emerges

The analogy is hard to ignore. DEC is quickly becoming to the mini market what IBM is to the mainframe world. And, despite their many successes, Prime, HEwlett-Packard, Wang, and Data General do have certain things in common with the members of the BUNCH (Burroughs, Univac, NCR, CDC, Honeywell). What they don't have is their own acronym ... PHEWD? (pronounced feud).

The point is not that the prospects for the PHEWD are as dim as those for the BUNCH, far from it. The analogy is that, like the BUNCH, the non-DEC mini vendors generally do not have diverse market interests, while DEC, like IBM, seems to have both the resources and desire to pursue a broad array of opportunities. Just as IBM is no longer just a mainframe company, DEC is rapidly becoming more than just a mini maker, and it is now clear that, for at least the next few years, DEC will be IBM's most important competitor (BUNCH included).

Unlike its minicomputer rivals, DEC is not easily characterized. The company seems committed to becoming a broad-based, vertically integrated supplier. Its Jupiter series of new mainframes will most likely be announced this year; it is the only mini vendor aggressively pushing personal computers onto the mass market; it is strong as a CAD OEM; its Decmate looks like a good word processor; and, after years of neglect, it is showing signs of aggression in the peripherals market to better milk its huge installed base of CPUs.

This realm of interests is exceeded only by IBM's. To meet the new opportunities, DEC has been steadily transforming itself to deal with the two key factors in today's market -- widespread distribution and manufacturing muscle. The changes are likely to go to the heart of DEC's matrix management system, which is not well suited to supporting production economies of scale. DEC realizes that in the future its principle competitors will not be just the members of the PHEWD, but also IBM, AT&T, and the Japanese, all three characterized by vertical integration and broad market interests.

A logical step would be for DEC to show more enthusiasm for joint ventures or remarketing agreements; eventually some type of service bureau may

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also be necessary, and closer ties to merchant semi makers might be useful. Last May, DEC agreed to market Floating Point Systems' array processors.

Stronger ties with Japanese firms are also a possibility. DEC has recently set up its first Japanese R&D facility, and upgraded its Japanese operations to the status of a fully-owned subsidiary, Nihon DEC. IBM has been particularly active in cooperative ventures with the Japanese (see page 8), apparently realizing that even its massive manufacturing capability cannot meet the many opportunities of today's market.

With a CPU base that exceeds that of IBM (not counting personal computers), DEC has long had substantial opportunities in the peripheral market that it has often failed to cash in on. The DEC-compatible vendors have gained a much larger percent of the DEC peripheral market than their IBM PCM counterparts.

Since peripheral sales can often account for half of minicomputer system value, it is essential that DEC maintain a dominant presence both for revenues and for growth. Much of its CPU base is entering a mature, replacement market era with storage sales becoming even more important. DEC's latest round of storage products are more aggressively priced than their predecessors and will put pressure on DEC's PCM rivals which, thus far, have had it relatively easy.

Perhaps most important of all, DEC is becoming much more concerned with handholding and customer satisfaction, especially in its sales of office equipment. As DEC increasingly competes directly against IBM, it must recognize the value of the "high touch" approach that has been Big Blue's trademark.

Has the recession hit bottom?

Since many of the key minicomputer companies have fiscal years that end in the June-through-September period, the full force of this recession is not accurately shown in many of the companies' 1982 annual reports. The real burden of this recession has shown up over the last six months, especially at DEC and DG. Wang, Prime, and HP appear to be getting through relatively nicely, while Tandem has seen its earnings shrink even with revenues growing. Comparisons of the last three to six months of 1982 and 1981 are given below:

DEC --	6 mos. ending 12/82.	Revenues up 7.6%; earnings down 37%.
DG --	3 mos. ending 12/82.	Revenues down 1.1%; earnings down 69%.
Tandem --	3 mos. ending 12/82.	Revenues up 32%; earnings down 8.5%.
Prime --	3 mos. ending 12/82.	Revenues up 19%; earnings up 16.6%.
Wang --	6 mos. ending 12/82.	Revenues up 31.7%; earnings up 37.9%.
HP --	3 mos. ending 1/83.	Revenues up 12.7%; earnings up 16.4%.

On the whole, the major U.S. minicomputer companies are not expecting a strong recovery in 1983. Since these companies were late to enter the recession, they may also be late to leave it, and only Wang seems assured of a solid year. The first half of this year looks particularly grim.

As is almost always the case, lower earnings and falling stock prices have led to rumors of takeovers, especially of Data General, although Prime and Honeywell are also mentioned a lot. At its recent stockholders' meeting, the DG brass tried to install anti-takeover measures, but had limited success. The company says it has not been approached by anyone, and reminds us that there has never been an unfriendly takeover in the information processing business.

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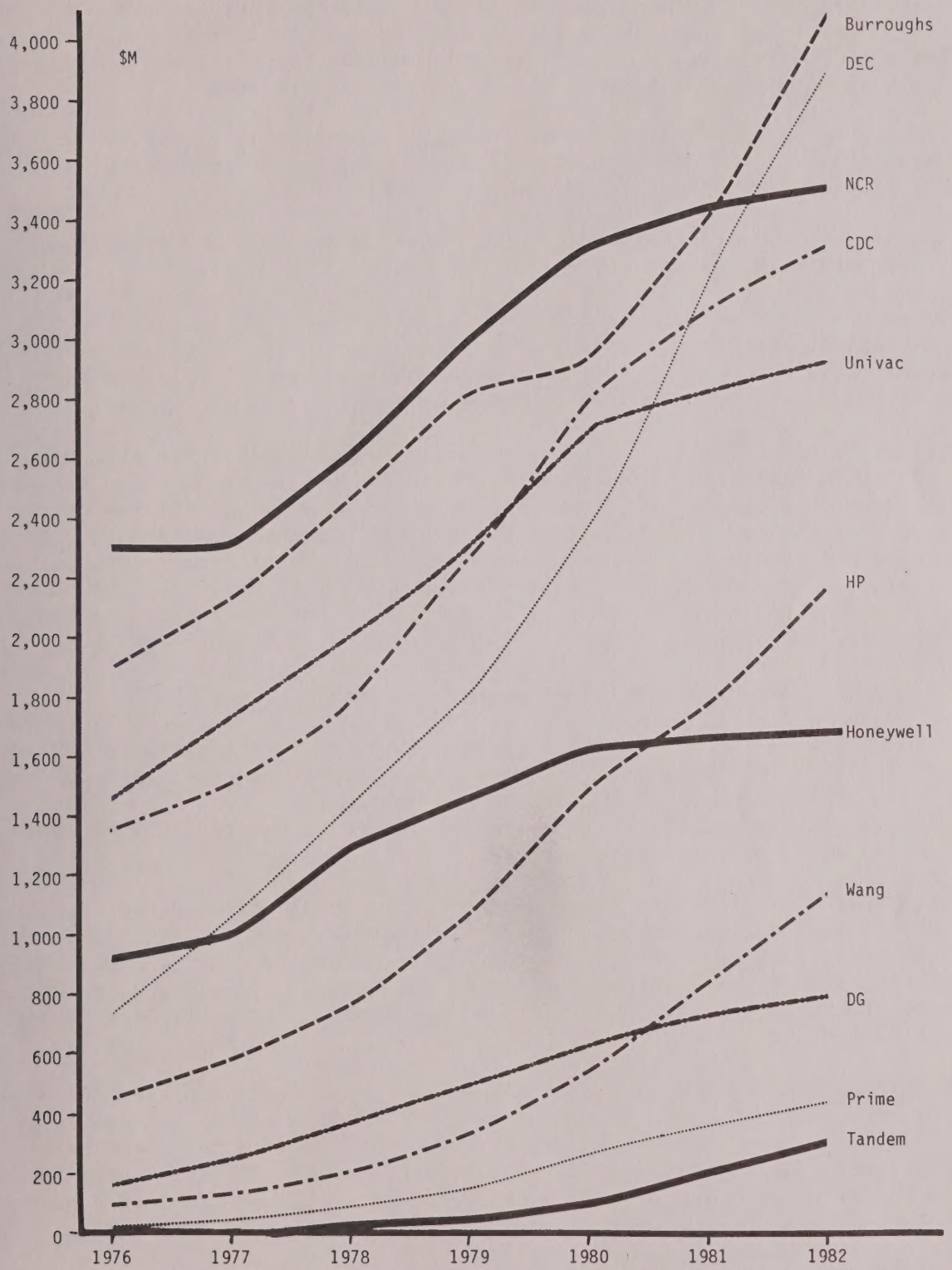
INFORMATION PROCESSING AND RELATED REVENUES, MAJOR MAINFRAME AND MINI MANUFACTURERS, IBM EXCLUDED, 1976-1982



Note: Burroughs revenues include 1982 sales by Memorex. Figures include sales of special purpose systems as well as forms and supplies.

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• IBM TO LIMIT SOURCE CODE ACCESS. In a move that has confused PCMs, independent software houses, and large users, IBM has decided to restrict, effective September 1, the availability of its source code for certain licensed products, including many related to MVS/XA. According to IBM:

"It is now more important than ever for IBM to protect its programming investment and technology. Our objective is to do so in an orderly manner with minimum disruption to our customers.

During 1982 we surveyed many of our customers, other software vendors, and GUIDE and SHARE management to determine how our objectives could be met without adversely affecting users of our licensed programs. We also examined the asset protection policies of other vendors. As a result of these studies, and after careful consideration, we have decided to move gradually toward a more controlled distribution of certain licensed program materials for selected IBM licensed programs."

Reactions have been mixed. Not surprisingly, the PCMs say that the move will have little short-term impact and that IBM has assured them they will have what's necessary to support /XA. Software and services firms will probably experience some inconveniences, but they don't believe that IBM is out to hurt them. (Adapso is still considering the issue and may release some type of formal statement or complaint.) Those users heavily into modifying IBM code could have some short-term troubles. IBM maintains that fewer modifications will make migration simpler, which is fine as long as users can meet their needs without such changes. Hitachi and Fujitsu, whose operating systems have borrowed heavily from IBM, look like the main targets of the action.

• IBM IS TALKING WITH MATSUSHITA. If IBM is looking to increase its low-end manufacturing abilities, Matsushita, the world's largest consumer electronics company with 1982 revenues of $10 billion, is an ideal partner. Under the proposed set-up Matsushita would make low-cost, high volume products of IBM design. Nothing is official yet, however.

• OPEL BECOMES IBM CHAIRMAN; AKERS NAMED NEW PRESIDENT. As expected John Opel, 58, has replaced Frank Cary, 62, as IBM chairman of the board; Opel retains his title of chief executive officer. New president John F. Akers, 48, was formerly head of the Information Systems and Communication Group, which is responsible for small systems and telecommunications. Like Opel, Akers' background is in marketing.

• HONEYWELL ANNOUNCES NEW 4341-SIZE MACHINES. Supporting both the GCOS 8 operating system introduced with the high DPS/88s and CP-6, the new DPS 8/47 and 8/49 fill in the middle of the DPS 8 line. The new machines use a high-speed version of TTL logic called Fairchild Fast, not the CML chips used in the high-end machines. Matching IBM, Honeywell also slashed its memory prices to $10,000 on its 4300-size systems, and to $25,000 on the DPS 8/50-70.

• COMMERCE STUDY SHOWS JAPAN IC EXPORTS TO U.S. DOUBLED IN 1982. While U.S. semi firms were struggling through a terrible year, Japan doubled its IC exports to the U.S. to $532 million. The U.S. exported just $159 million to Japan. MOS RAMS were the key sector with Japanese exports of $215 million.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR FEB. 16, 1983 ● V/18, NO/20 P.J. MCGOVERN, PUBLISHER

U.S. gropes for technology trade policy -- page 7

IDC MIGRATION STUDY INDICATES STRONG 3083 SHIPMENTS; NAS DROPS OUT OF CPU MANUFACTURING BUSINESS

Though hardly a price/performance breakthrough, IBM's 3083 series has such a huge potential replacement market that it is virtually guaranteed to enjoy substantial shipments over the next two years.

That's the conclusion reached in International Data Corp.'s annual survey of the migration patterns and plans of IBM's mainframe installed base. The 3083s are drawing significant interest from three main groups: 370 148/158/168, 3031/3032, and 4341-2, an installed base of over 4000 CPUs in the U.S. alone.

Looking at the available PCM offerings, IBM will probably not suffer serious losses to its PCM competition in the size class six (3083) region. With the exception of NAS' 9040, the PCMs have not targeted the 3083 area, and new high-end class five machines by NAS and IPL won't be shipped until the third quarter of 1983. In fact, the IDC survey showed that out of some 100 IBM class 5, 6, and 7 CPUs being replaced in 1983, only one is switching to a PCM vendor.

Nevertheless, the PCMs are enjoying substantial high-end success. NAS is reporting steady shipments and high levels of customer satisfaction for its 9000 series and Amdahl expects strong sales (180 CPUs in 1983) now that the bugs in its 5860 have apparently been worked out. Some other points of note:

- NAS is getting out of the CPU manufacturing business, dropping its 6100 line and becoming dependent on Hitachi for all its hardware. Because of Hitachi's high reliability, NAS feels comfortable keeping prices about 85% to 90% of IBM's, instead of the traditional 75%-80%.

- IPL has taken a new tack, offering its new 4480 with redundant features. Like NAS' 6600, the 4480 is aimed at the low-end of the gap between IBM's 4300 and 308X lines.

- Reflecting IBM's unattractive lease prices, the percentage of 4300s on IBM lease has dropped from 60% in 1981 to 44% in 1982.

- 4331 users are switching to 4341s in significant numbers.

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CHANGING COMPOSITION OF IBM SIZE CLASSES, U.S. INSTALLED BASE, 1979-1984
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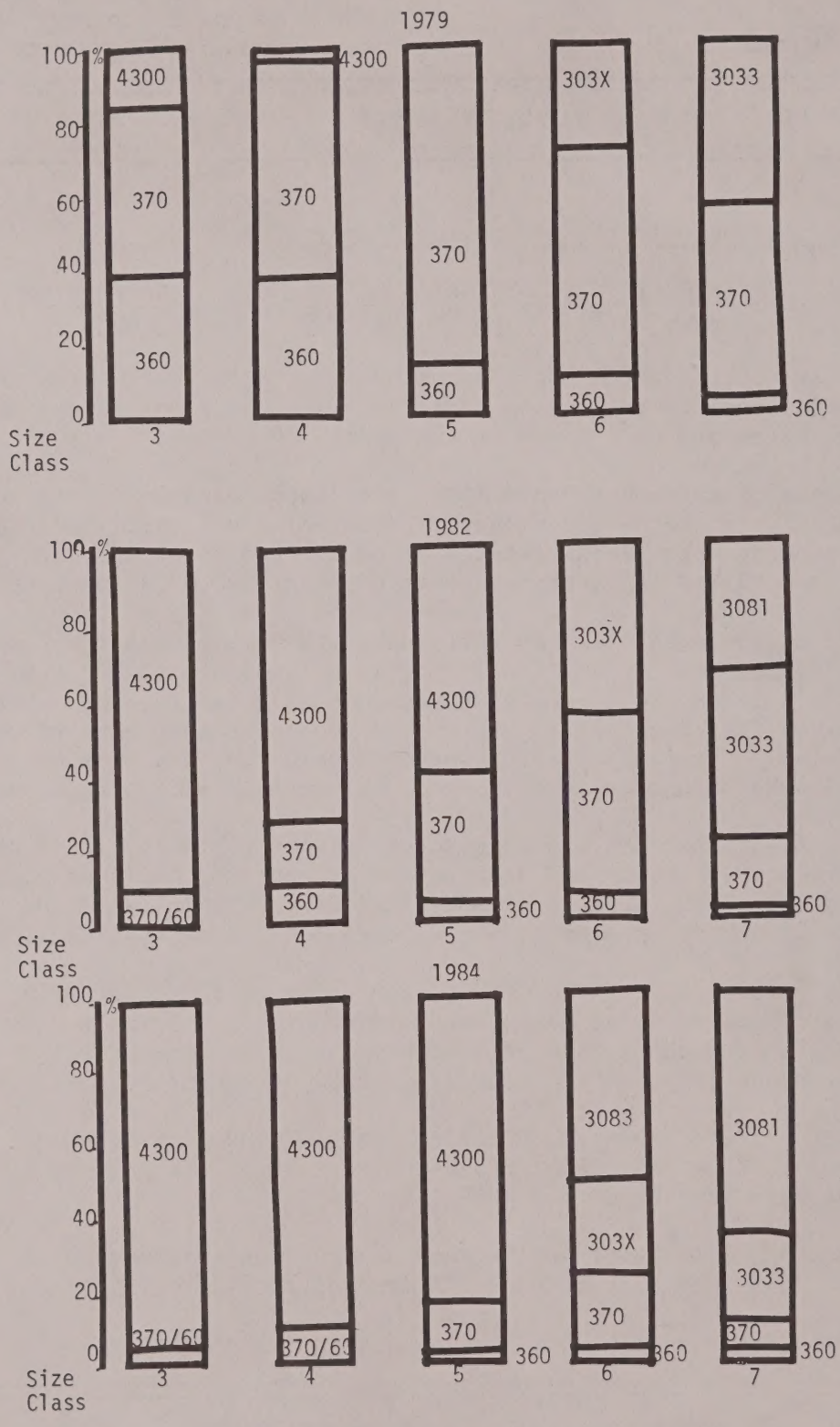

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EXISTING IBM SYSTEM POPULATIONS BY SIZE CLASS, U.S. INSTALLED BASE, 1979-1984
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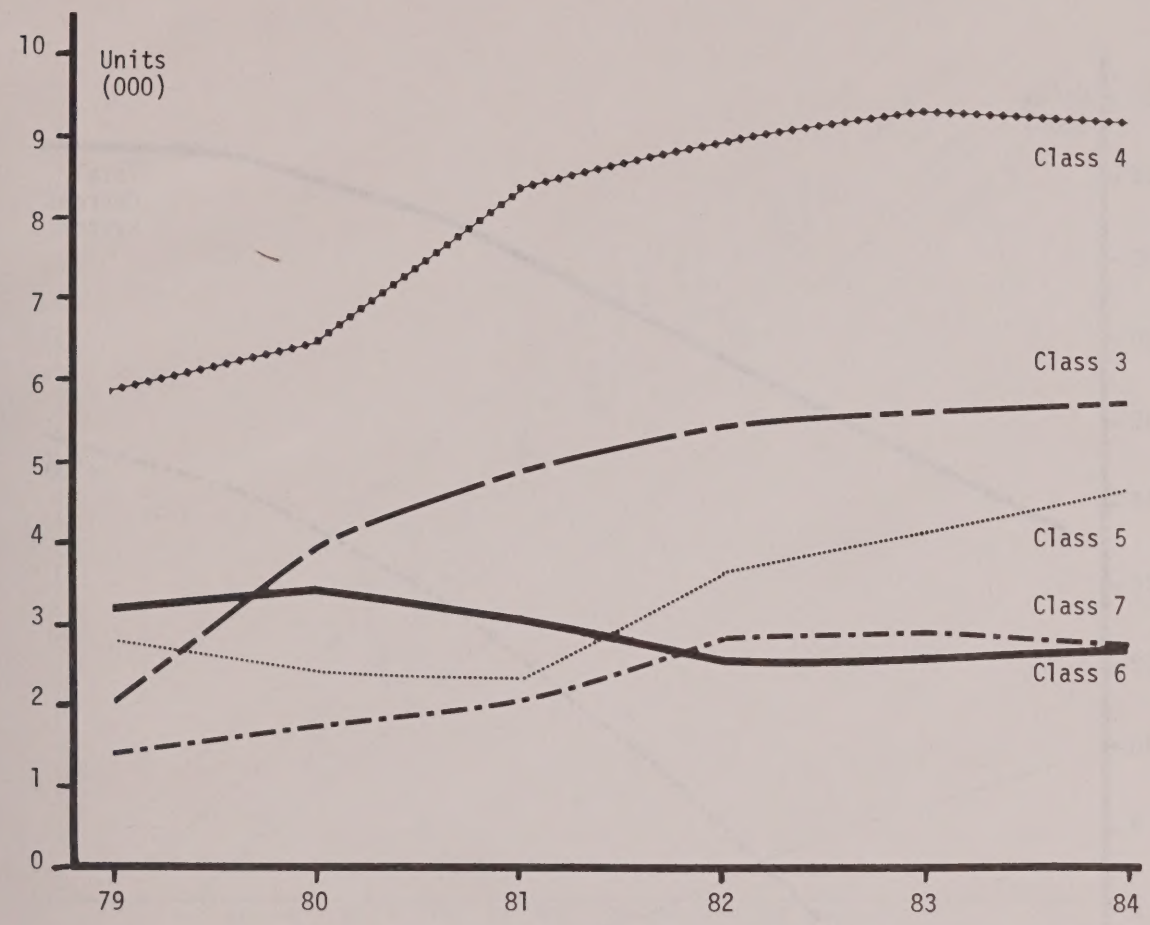

IDC' SIZE CLASS GROUPINGS, IBM EQUIPMENT

Class 3	Class 4	Class 5	Class 6	Class 7
360/20	360/30	360/50	360/65	360/67,75
360/22	360/40	370/145	370/155	360/85,95
360/25	360/44	370/148	370/158	370/165
370/115	370/125	4341-2,11,12	3031	370/168
4331-1	370/135		3032	3033U
4321	370/138		3033S	3033N
	4331-2,11		3083E,B,J	3081D,G,K
	4341-1,9,10			3084

Note: The above groupings have been determined by IDC after segmenting specific product families (360, 370, 4300, etc.) and identifying certain groups of users and their likely migration paths, i.e., users of 370/148s are most likely to move on to a 4341-2. As in any artificial segmentation, there are grey areas where certain machines could have been grouped in either of two size classes, significantly affecting size class populations. Despite the strong 3083 shipments, the size class six installed base will rise only slightly due to heavy retirements of 3031s and 370/158s. The size class five base is rising quickly because retirement rates are relatively low.

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IBM 360/370/4300/303X/308X U.S. INSTALLED BASE, 1979-1984
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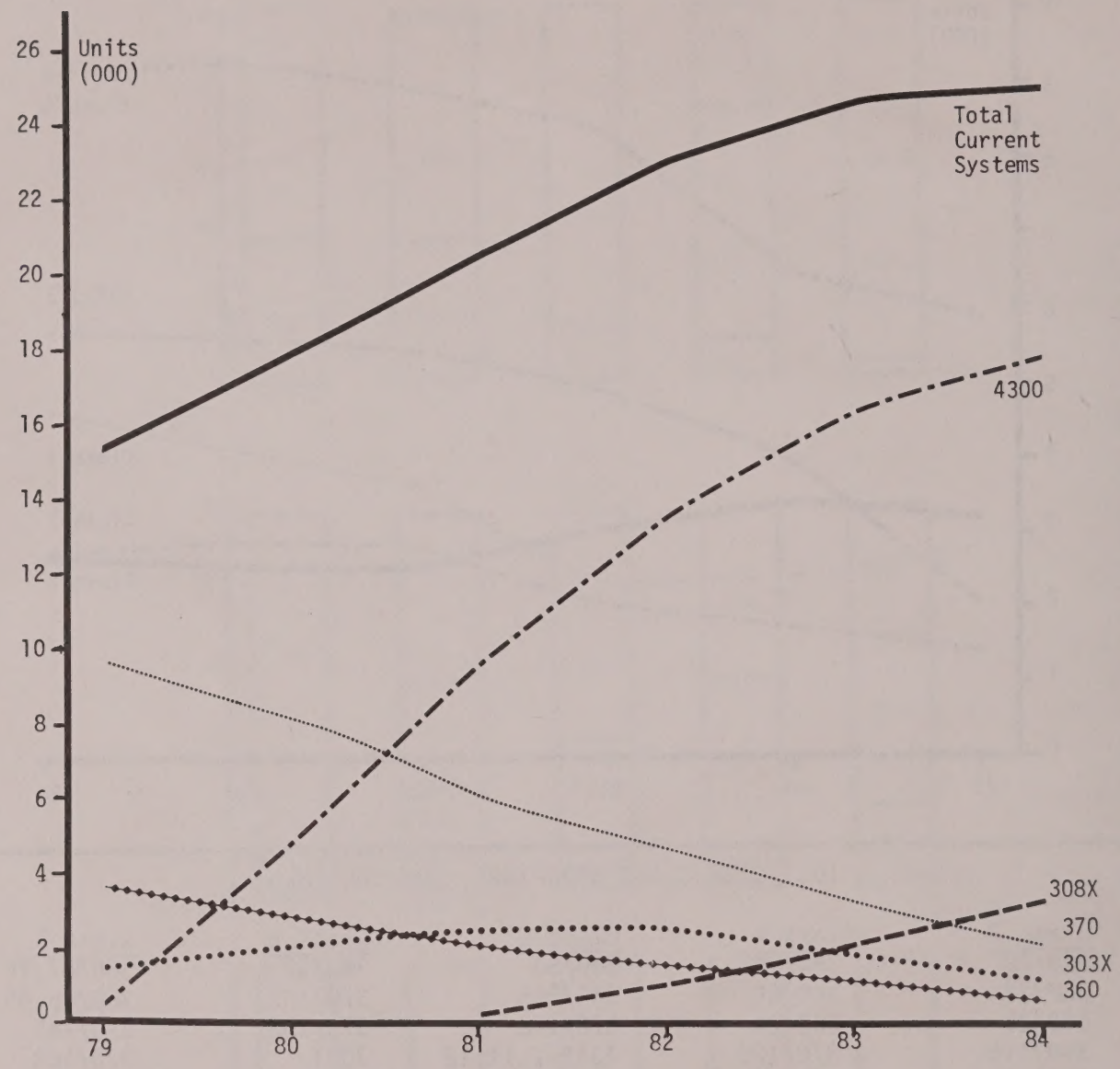

Notes and assumptions: The numbers above represent the forecast of existing IBM CPUs; a replacement family for the 4300s or new low-end 308Xs could slightly alter the above scenario.

Although the PCMs have, in general, had more success at the high end, it is no wonder that many are still attracted to the mid-range market. The base of systems for replacement is more than three times that for size class six and seven machines. Unfortunately for the PCMs, as the chart on the next page shows, IBM price pressure has been severe in the 4300 area, and no one is really hurting IBM in the 4300-compatible marketplace. It is unlikely that NAS' new 6600s can significantly change this picture.

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PRICE vs. PERFORMANCE, CURRENT IBM/PCM CPUs
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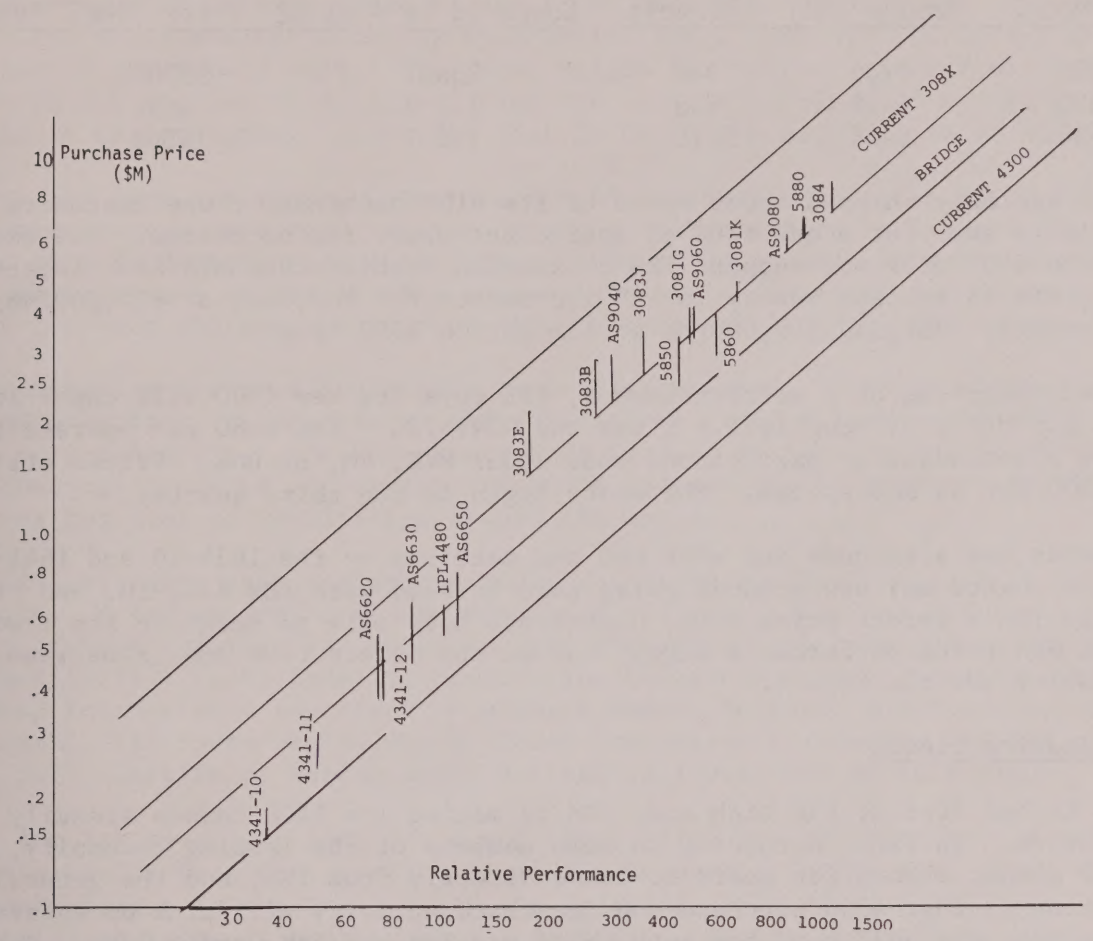

New gear and strategies from National, IPL and Cambex

Because Hitachi's high-end products are developing such a strong reputation for high performance and reliability, National Advanced Systems is no longer forced to compete with IBM on pure price criteria. A spokesmen at NAS confirmed that NAS has raised its pricing strategy from the traditional 75% to 80% of IBM's price up into the 85%-90% range, a policy that also includes NAS' expanding peripheral sales. NAS likes to cite a recent Reliability Plus study that showed a mean time between failure of 19,000 hours for its 9000 series, compared to about a 2,800 MTBF for IBM's 3081.

A second part of the NAS strategy is to offer a full line of mainframes so that it is not totally dependent on one segment of the market like Amdahl is. NAS now has a substantial worldwide base for its low, mid, and high-end systems, about 500, 180, and 80 systems respectively. With its full line of Hitachi peripherals, its revenue base is more stable than that of other PCMs.

NAS' decision to go totally to Hitachi's systems is hardly a surprise. This is not the first time that NAS' San Diego facility has become a burial ground for a fizzled system, and NAS would have been hard pressed to match the reliability standards found in Hitachi's high-end products.

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NAS has dumped its 6130 and 6150 processors, announced last April, in favor of three modified versions of Hitachi's 240H. The new line-up is given below:

NAS Model	Memory (MB)	Channels	Compared to 4341-12	Price (4MB)	Avail.
6620	4-16	5-8	Equal	$370K	3Q/83
6630	4-16	5-8	1.2 X	465K	3Q/83
6650	4-16	5-10	1.6 X	580K	3Q/83

NAS had only shipped about seven of its 6100 machines; those customers will be able to swap for a new 6600 of equivalent power for no charge. NAS says that the 6600 will not support IBM's extended architecture MVS/XA. Interestingly, NAS is selling memory in 4MB increments for $60,000, or $15,000/MB; IBM is currently charging $10,000/MB on its entire 4300 line.

When operating as a multiprocessor, IPL says its new 4480 will check in at about 2.6 MIPs, or roughly 1.6 times the 4341-12. The 4480 can operate in either a redundant or partitioned mode under MVS, VM, or DOS. Prices start at $547,000 for an 8MB system. Shipments begin in the third quarter.

Cambex has also come out with two new machines -- the 1636-10 and 1641-11. Neither charts any new ground, going head-to-head with IBM 4341-10, and -11. Despite IBM's latest price cuts, Cambex has been able to maintain its traditional 30% price/performance edge. Cambex now offers five models between the IBM 4341-9 and the 4341-2.

4300 leasing trends

As it has done at the high end, IBM is making its 4300 leases steadily less attractive. In fact, according to some members of the leasing community, it is now almost absurd for users to lease directly from IBM, and the general expectation is that 4300 purchase and leaseback activity will pick up substantially over the next year for both third parties and IBM Credit Corp. But as the chart below shows, there are still a great many 4300 systems on lease from IBM. With thousands of systems on lease, IBM is not likely to decimate 4300 residual values in the immediate future.

IBM 4300 SERIES U.S. INSTALLED BASE, RENT, LEASE, PURCHASE, 1981-82
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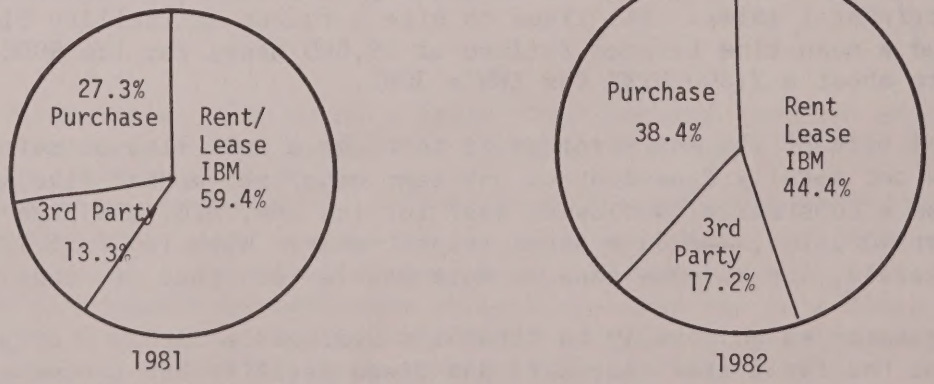

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GOVERNMENT GROPES FOR TRADE POLICIES: WASHINGTON HEARINGS PROLIFERATE, BUT WITH LITTLE CONSENSUS

The Department of Defense doesn't want to be dependent on Japanese supercomputers. The Semiconductor Industry Association fears that U.S. firms are dropping out of the memory race. President Reagan has become enamored of technology's future and everybody agrees that the schools aren't good enough and capital is too expensive. But just what is Uncle Sam supposed to do about it?

Over the last six weeks, Congress, the Administration and the major technology trade groups have been holding hearings in Washington to discuss the future of U.S. technology and the proper role of government support. Not surprisingly, because of conflicting interests, little consensus has emerged except for such unarguables as more R&D, better schools, and "fair trade."

Those hoping for more are likely to be disappointed. Despite alleged Japanese mispractices, an aggressive and retaliatory trade policy might well prove to be self-defeating. The U.S. has a huge surplus in its international trade of technology products and cannot afford to endorse bilateral protectionist policies for fear of retaliation around the world.

Political considerations aside, many U.S. firms would argue against such measures. Multinational computer vendors don't want to be cut off from their supply of high quality, low cost Japanese products which help them compete internationally. Additionally, cooperation between U.S. and Japanese firms is becoming increasingly important -- witness Amdahl/Fujitsu, NAS/Hitachi, Sperry/Mitsubishi, IBM/Epson/Sankyo Seiki, Texas Instrument's Japanese 64K RAM operation, etc. Tariffs or quotas would not sit well with any of this group.

As for tax measures, both large and small firms are pleading for relief, but despite Mr. Reagan's questioning of the corporate income tax, given the Congress' budgetary constraints and the pressing needs of less well-off industrial sectors, it seems unlikely that the computer industry will be singled out for any meaningful special treatment. Some form of further R&D incentives is, however, well within the realm of possibility.

On the research side, the Department of Defense is being looked toward as a potential white knight, expected to put up millions to sponsor the U.S. answer to the Japanese fifth generation computer project. It seems clear that neither Control Data nor Cray Research is going to be able to keep up with the Japanese on their own, and though supercomputers are not a substantial market in terms of dollars, they are important to the national interest. DOD's concern is well justified, and even IBM has shown interest in joining such a project.

There is certainly some room for further joint military/industry/university research, especially at the base technology level, but if U.S. industry is to maintain its technological leadership it will have to do 90% of the work itself. There just isn't that much the government can realistically do; the contributions of Japan's MITI are often exaggerated and not easily imitated.

In the long run, the only way the U.S. can fend off the Japanese attack is by having stronger companies with better products. This means joint ventures, aggressive exports, and heavy R&D. As CDC's William Norris has said, large U.S. firms must find ways of working with small businesses. Given today's laissez-faire antitrust climate, such consolidation is now quite feasible.

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• NON-IBM MAINFRAMERS HAVE ROUGH 1982. While IBM was riding its 3081s to its best revenue and earnings growth in years, other U.S. mainframers had sad stories to report. Things weren't too bad at Burroughs. By taking advantage of a favorable accounting changes, Burroughs could report a 1982 earning increase of 11%. But without the changes, earnings for 1982 would have fallen 21% from 1981, which wasn't that good a year either. Burroughs' revenue, however, was up 23% over 1981, as the company cracked the $4 billion barrier.

NCR continues to tread water. Revenues were up just 3% over 1981 to $3.5 billion. Earnings, however, were up 13% to $234 million, reflecting NCR's success at cutting costs, but failure to generate new business. NCR reports that a stream of new products should help turn this around by mid-year 1983.

At Control Data, earnings were down 9% to $155 million, and earnings from its computer businesses were down 28%. Computer business revenues were up just 6% to $3.3 billion, and overall company revenues were up 5% to $4.3 billion. CDC noted that its systems and services businesses enjoyed modest increases, but not enough to make up for the dropoff in its peripheral business which in 1981 contributed 43% of the company's computer business revenue.

At Honeywell, Information Systems profit was down 49% to $80 million on revenues of $1.6 billion. Additionally, Honeywell reports "order deferrals and cancellation and a sharp decline in new orders ... business entered 1983 with substantially lower backlogs." Honeywell expects another difficult year in 1983, especially in the first half. Overall corporate earnings were up 5% to $272 million on revenues of $5.5 billion, up 3%. Sperry Univac's fiscal year ends March 31, when it will report similar difficulties.

• HITACHI PLEADS GUILTY TO TECHNOLOGY THEFT CHARGES; IBM AND NCR SQUARE OFF. In a surprising move, the giant Japanese firm and two of its employees pleaded guilty to Federal criminal charges. Hitachi will pay a $10,000 fine; the two employees were also fined and placed on probation. IBM civil suit against Hitachi still remains. In another case, IBM and NCR are squabbling over the software used in NCR Comten's 3705-compatible front end processors. IBM is claiming that Comten is using copyrighted IBM software, and Comten is saying that IBM is trying to limit competition. IBM continues to stress that it will do whatever is necessary to protect its technology.

• TI SHOWS 8088 PC. Texas Instruments is challenging IBM's personal computer head on in what looks like a battle of manufacturing muscle. TI's price looks like about $500 less than comparable IBM configurations while offering winchester disk and voice recognition options. Surprisingly, although TI and IBM use the same Intel microprocessor, the two are not strictly software compatible. Because it plans to sell in high volumes, TI expects few problems getting software houses to convert their products for its machines. The TI Professional Computer is available now. Expect a heavy media blitz.

• STC CRASHES $BILLION CLUB. Although it wasn't a great year out in Colorado, STC did pass the magic milestone, with 1982 revenues of $1,079 million. When its fiscal year ends in March, there may be another in the club -- MCI.

• FCC WILL NOT STOP IBM/INTEL DEAL.

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"The Gray Sheet"

DAVID MOSCHELLA, EDITOR JAN. 28, 1983 • V/18, NO/19 P.J. MCGOVERN, PUBLISHER

AT&T since the settlement -- Page 4

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IBM ENJOYS BIG YEAR, BUT NEW MACHINES NEEDED BY 1984 TO KEEP PACE

Thanks to massive shipments of 3081 mainframes, 1982 turned out to be a banner year for IBM. Revenues were up a heady 18% to $34.3 billion, and earnings soared to $4.4 billion, up 22%. After years of indifference, Wall Street has suddenly jumped on the Big Blue bandwagon, temporarily driving IBM's stock price up over the magic $100 per share mark.

But how will the giant sustain such a pace? The 3083 series will keep up the high end for the next two years, but with 4300 sales expected to taper off sharply, overall shipment activity will fall unless IBM makes some major product introductions in 1983, scheduled for 1984 delivery.

Despite the success of its personal computer, mainframes will continue to be IBM's bread and butter for the foreseeable future. In the U.S. alone, the sale of 3081 processors accounted for some $3.5 billion in 1982, not including the substantial revenues from peripherals, software, and maintenance.

Over the last decade, IBM has successfully juggled its mid-range and high-end product cycles so that at any given time either one or the other has been in a peak shipment period. This has enabled IBM's overall manufacturing output to expand relatively smoothly. If this pattern is to continue, new 4300-size systems must arrive by mid 1984 at the latest. A few points of note:

- A bridge machine between the 4300s and the 308X will probably be announced within the next six months. Look for a 308X machine with the approximate power of the 3033S, but for much less money.

- The processing power of 308X machines shipped in 1982 and 1983 will nearly equal the total IBM power installed at year-end 1981. In terms of MIPs, the overall power of the IBM installed base is growing at some 30% per year, more than doubling every three years.

- Although 4300 shipments are waning, because of their vast numbers, they will continue to be a major market for peripherals and software. The 4300 series will be four years old in April.

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DOLLAR VALUE OF IBM U.S. MAINFRAME SHIPMENTS, 1974-1984
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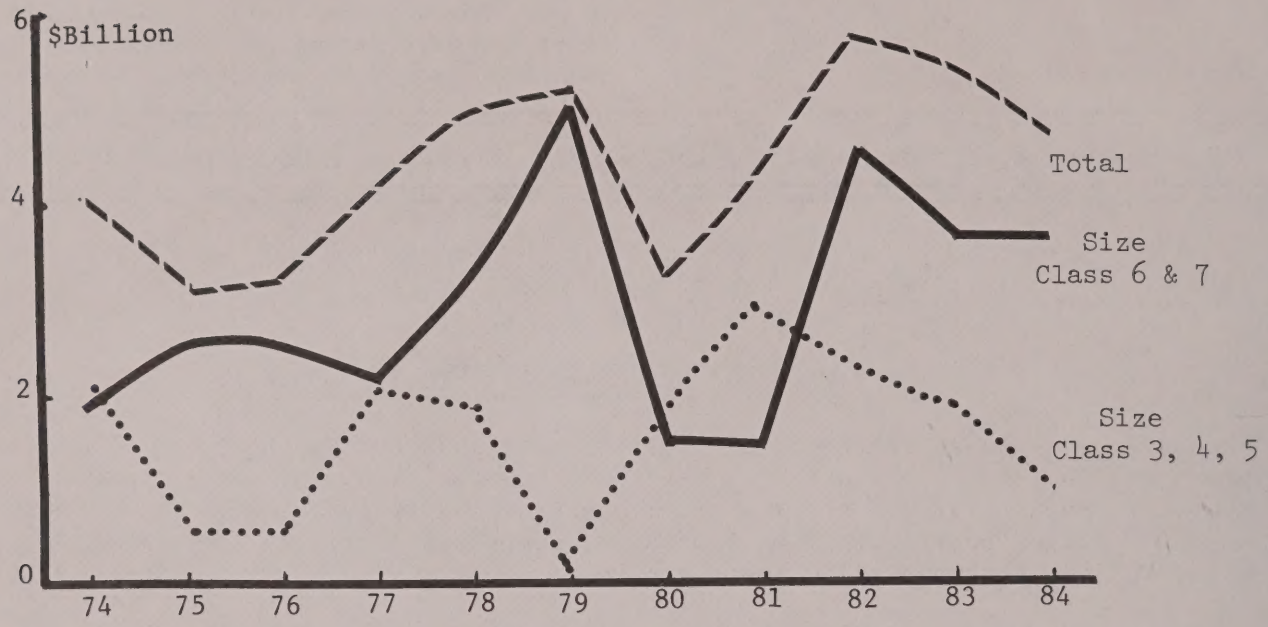
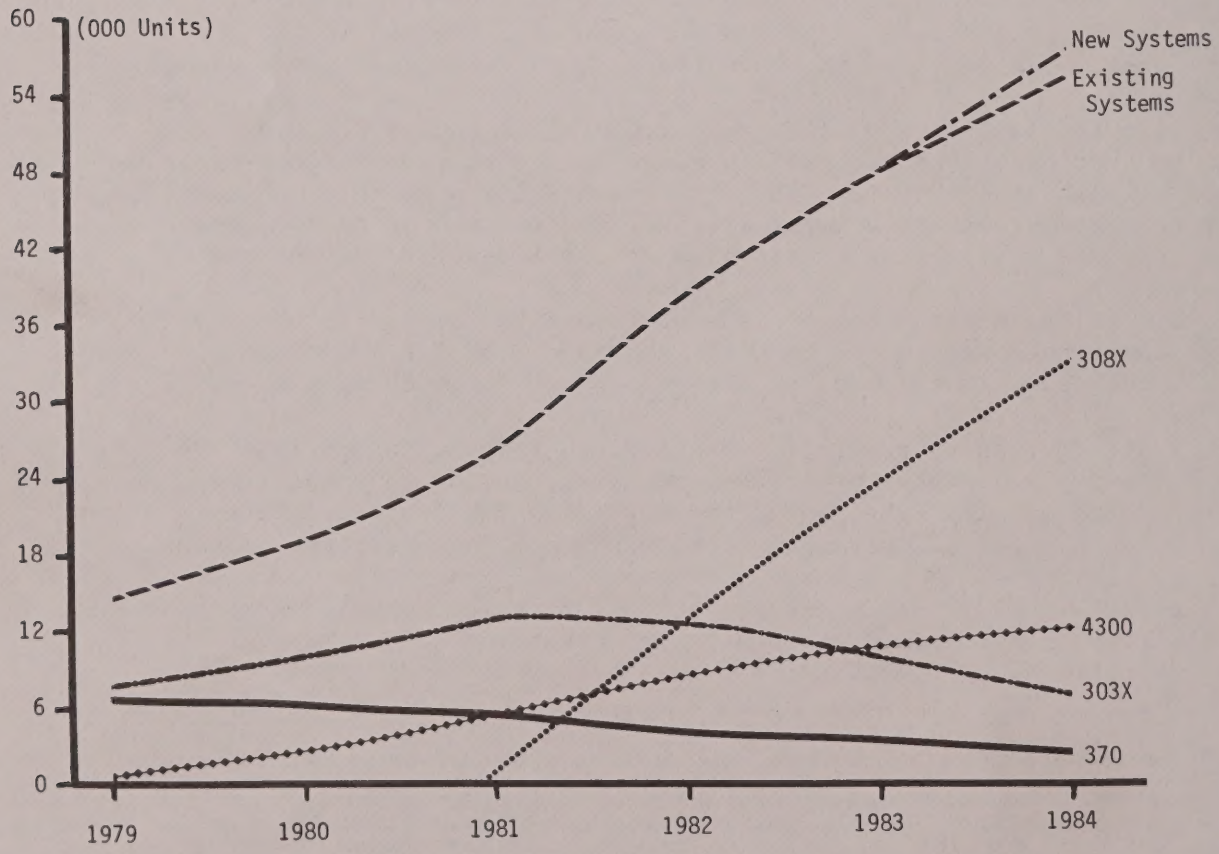


TOTAL IBM 370-COMPATIBLE PROCESSING POWER INSTALLED
(Copyright 1983 -- International Data Corp.)



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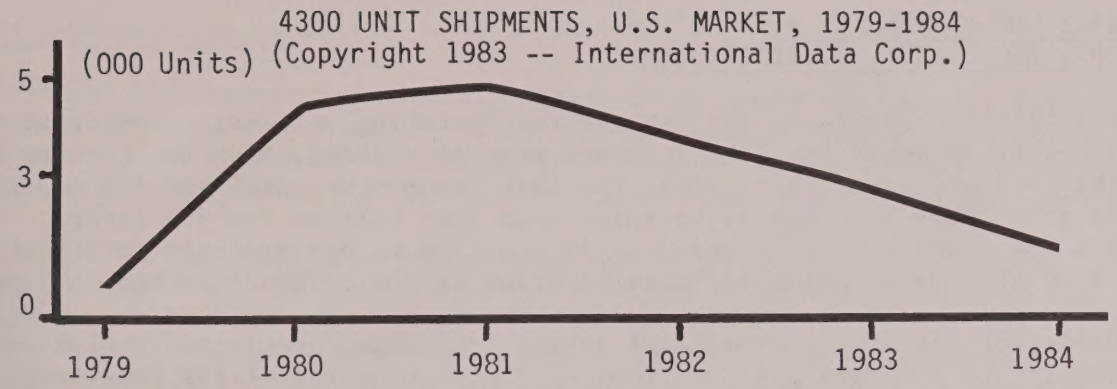

With some thirteen thousand 4300 systems installed in the U.S. at the end of 1982, IBM has a replacement market of unprecedented size. The number of latest generation size class 3, 4, and 5 systems is 60% greater that it was at the height of the 370 era. By the time the 4300s are through, their installed base will be about twice the peak population for similar class 370s.

But replacing the 4300 series may not be all that easy. When the 4300s were announced, they decimated 370 residual values by, on the average, doubling system power at about half the price. If the 308X series extends down to the range of the 3033S, there will still be room to approximately double the 4300's power range without invading 308X territory, but whether IBM will drastically cut prices again is doubtful given that the 308X series hasn't matched the original, let alone current, 4300 price/performance rate.

Action on the high end

Although it is almost certain that new 4300s will be introduced before any 308X replacements, IBM is giving signs that new high-end mainframes may be on the way sooner than its history would dictate. Product cycles are definitely shortening, due in part to accelerating technological developments and in part to much tougher PCM competition. With Trilogy, Amdahl, Fujitsu, and Hitachi/NAS in the PCM business, IBM can no longer let its own profitability picture solely determine its product cycles. EDP/IR expects that all four of the above firms will be capable of delivering systems in the 40-50 MIP range by 1985.

Because of its emphasis on purchase, when it becomes time to replace the 308X, the value of the lease base will not be as much of a consideration as it has been in the past, although IBM is not likely to treat IBM Credit too roughly. Purchase/lease ratios for the 308X series are now in the low 30's, and in its continuing efforts to make its own leases less attractive, IBM has recently cut the purchase accrual rate on 308X leases.

PRODUCT LIFE CYCLES -- IBM SIZE CLASS FOUR AND SEVEN MAINFRAMES

Size Class 7	Date First Inst.	ΔMo.	Size Class 4	First Inst.	ΔMo.
7030	5/61		1410	11/61	
360/67	1/66	55	360/30	6/65	43
370/165	6/71	66	370/135	5/72	83
3033U	3/78	81	4341-1	10/79	89
3081D	10/81	43	New?	6/84?*	58?
309X?	6/85?*	44?			

* Shipment dates are estimates and are given for perspective purposes only.

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AT&T SINCE THE SETTLEMENT --
CONFIDENT, AGGRESSIVE, MULTINATIONAL

A company that is undergoing the largest restructuring in American business history better at least act like it knows what it's doing, and thus far the "new AT&T" has done just that. Over the last few months, AT&T and its American Bell subsidiary have let it be known that they believe the regulatory obstacles are clearly behind them. It is now time to aggressively pursue what they see as the nearly unlimited possibilities of the information age.

Considering the high stakes, conflicting interests, and legal complexities, regulatory progress has been rapid. The combination of the Computer Inquiry II and the settlement of the AT&T case (the so-called Modified Final Judgement) has left few objectors, and even the nitty gritty of splitting up the Bell system's assets and employees seems to be going better than expected, although the key issue of access charges has yet to be fully ironed out.

When the divestiture is complete in January 1984, it will be up to AT&T to make the deal pay off. Since the company has been eyeing unregulated markets for the better part of a decade, perhaps it is not surprising that Ma Bell is moving quickly. Nevertheless, the pace of activity has been impressive and Bell has indicated that it will continue to make headlines. Among some of the noteworthy events of the last few months:

- International moves. A possible joint venture between AT&T and N.V. Philips is causing much consternation in Europe. The FCC has given AT&T the go-ahead for overseas data transmission, and for the first time AT&T is considering extensive overseas manufacturing. AT&T International will steadily increase in stature.

- New products. Just two weeks after American Bell opened for business, it unveiled some of its data network strategy. Integrated voice, data, energy, and security is the main pitch. The long-rumored Antelope now appears to be more of a communications architecture than a specific PBX product. Lots of new office software and hardware is on the way, especially workstations. For now at least, AT&T is opting for twisted pair local networks.

- New markets for Western Electric. Although many are skeptical of WE's ability to compete in the merchant semiconductor business, WE has made it known that just about everything it makes will be available to non-Bell users, including 256K RAMS. Western is also having talks with Sears.

- Divestiture terms. Bell's assets and employees are being divided up according to main use criteria. The new AT&T and the Bell Operating Companies are expected to be fully separated by January 1984. In a related case, the FCC must decide whether to approve GTE's proposed takeover of Southern Pacific Communications.

- Access charge decision. A newly defined access charge scheme is intended to replace the subsidy that long-distance revenues have provided to local rates. There will also be subsidies for rural service. The move could have major implications for non-Bell carriers such as MCI.

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International factors

Given the increasing sophistication of the world economy, an expanding market for telecommunications equipment is certain. And because telecom technology is highly transferable, this is a market that lends itself to large-scale manufacturing and offers significant export opportunities.

Up to this point, however, protectionist policies have severely limited the international trade of telecommunications equipment. European and Japanese telephone companies are fully owned by the government and operate as pure monopolies which have historically looked to domestic suppliers. AT&T, though a private corporation, has had little incentive to look outside for equipment supplies, since its profit margins have been relatively fixed.

In the U.S., this situation is expected to change significantly over the next few years. The AT&T divestiture will, at least theoretically, take away Western Electric's captive markets. Although this is generally seen as a boon for North American suppliers such as Rolm, ITT, Mitel, and Northern Telecom, in the long run the Japanese may turn out to be the biggest benefactors of all.

Over the next ten years, many Americans will be buying their own phones; the deregulation of customer premise equipment assures this. Low-cost, high-quality, and feature-oriented phones will be in demand, attracting everyone from Radio Shack to International Telephone and Telegraph. The current boom in cordless phones is just the first step toward tranforming the phone into status-laden consumer gadgetry. Given their record in similar consumer markets, the Japanese must be closely watched.

The Japanese are also strong in sophisticated high-end equipment. Because Japan's Nippon Telephone and Telegraph looks to outside firms for many of its needs, companies such as NEC, Fujitsu, Oki, and Hitachi have a great deal of experience in developing sophisticated switching devices. Oki has already signed an agreement for its PBX hardware with Standard Telephone.

Low-cost manufacturing has never been a top priority at Western Electric, and if AT&T is going to compete successfully in the new market, it will probably have to utilize off-shore manufacturing facilities. Recently, AT&T has had talks with the Taiwanese government, and some type of venture there is anticipated. GTE and ITT already do extensive overseas manufacturing.

The much talked about linkage between AT&T International and N.V. Philips may help change the European picture. Since European governments do not want to see their markets overrun by American and Japanese suppliers, some type of tie to a continental firm will be necessary for U.S. or Japanese success. Philips has lots of experience with marketing consumer products and is entrenched in many European markets. If Western Electric can indeed turn out competitive products, AT&T may well have a line on a substantial new market.

As of today, the two firms have signed an agreement in principle to form a 50/50 joint venture to market central office switching equipment internationally. Other products will most likely be added before the planned fall start-up. Philips also has a cooperative agreement with Sweden's L.M. Ericsson.

Recently, there have been a few signs of a slow deregulation of the European marketplace. In 1981, legislation allowed non-British Telecom modems to

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N.V. PHILIPS AT A GLANCE

Official Name -- N.V. Philips Gloeilampenfabrieken (Philips Incandescent Lamp Works), incorporated in the Netherlands.
1981 Revenues -- $16.3 billion. 76,000 employees.
Principle Business -- Lighting and batteries, home electronics and appliances, telecommunications, information processing, semiconductors, and defense and medical systems.
Data Products -- Word processors, small business computers, desktop computers, videotex, and optical storage.
Telecom Products -- PBXs, microwave equipment, fiber optic cable, mobile phones, modems, teleprinters, cable and wire.
Research & Dev. -- 4,000 employees, half in Netherlands, half in Europe and U.S. Strong in optical technology, speech recognition, and gate array chips, the latter involving Synertek.
U.S. Subsidiary -- North American Philips Corp. 1981 revenues $3 billion.
U.S. Brand Names -- Magnavox, Sylvania, Philco, Norelco.
Sales by Region -- Western Europe (56%); U.S. & Canada (22%); Latin America (8%); Asia (7%); Australia (4%); Africa (3%).

TELEPHONE POPULATIONS AROUND THE WORLD, 1981

Nation	Telephones (M)	Population (M)	Phones per 100 people
United States	182	226	80
Japan	55	118	47
G. Britain	27	56	48
France	22	54	41
W. Germany	22	61	36
U.S.S.R.	22	268	8
Italy	18	57	32
Canada	15	24	62
Spain	11	38	29
Netherlands	7	14	49
Australia	7	15	44
Brazil	6	124	5
E. Germany	3	17	18
India	3	700	0.3

Source: 1983 World Almanac; some data is for 1980.

be hooked to the British system. In West Germany, the PTT is being taken to task by the European Commission for its overly rigid procurement policies, and in 1981, IBM surprisingly won a contract to build Germany's videotex network. Nevertheless, the overall situation is one of control. National PTTs tend to specify not only what products can be hooked to the network, but from what manufacturers. Established companies like Philips, CIT-Alcatel, Siemens, and L.M. Ericsson will continue to pull in the lion's share of the market. As for Japan, Northern Telecom will be selling its PBXs there through Mitsui.

The FCC has also taken a step toward increasing international competition. In December, it gave AT&T permission to offer overseas data services, and permitted the five International Record Carriers -- ITT World Communications, RCA Global Communications, FTC Communications, MCI Communications, and TRT Telecommunications -- to offer overseas voice services. Any enhanced data services from AT&T must be offered through American Bell or another separate subsidiary.

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Regulatory hurdles

Harmless looking at first glance, the issue of access charges between local operating companies and long-distance carriers holds many implications for the future economics of today's telephone services and any bypass technologies -- digital termination systems (DTS), cellular radio, CATV, etc.

The FCC is faced with the dilemma of keeping the Bell operating companies (BOCs) solvent while holding down rates enough to maintain nearly universal service. Under the old system, profits on long-distance revenues were used to subsidize local services. By charging long-distance customers for connection to the local system, the FCC hopes to retain some form of BOC support.

Unfortunately, such access charges run the danger of being counter-productive. If the charges are made too high, they will make the available bypass "last mile" technologies look more attractive, especially to big business which generates the vast majority of interstate voice service.

A crucial FCC decision made last December detailing access charge procedures has gotten surprisingly little attention. The net effect will be that local rates will rise and long-distance rates will fall, better reflecting the existing cost structure; various business and residential surcharges will be tacked on to increase BOC revenues. Additionally, a Universal Service Fund will be established to help subsidize expensive rural areas. Interested parties have until February to comment.

New roles for Western Electric

Since Western Electric stands to lose at least some of the business it has had with the BOCs, one can expect the captive supplier to make some aggressive attempts to bring in new business. The key question remains whether Western's years of isolation from the marketplace will make it difficult for the $13 billion manufacturing giant to compete.

Entering the merchant semiconductor market and pushing AT&T International into joint ventures are only part of the solution. Western has already had extensive talks with Sears Roebuck to market home phones which are also sold through AT&T's 1800 phone stores. It also is planning to beef up its marketing capability, especially to large Fortune 500 accounts.

American Bell is the third key part. ABI has said that it intends to be in the workstation market in a "big way," with many of the products tied to the new Dimension/85 digital PBX. The /85 will offer 64Kb datacom (promised), links to Net 1000, new office management software (promised), terminal emulation, and sensor-based energy and security management. According to ABI, the key features of the system are its expandable architecture and the protocol that integrates voice and high-speed data. The user interface is the same whether the user is communicating through Net 1000 or the local /85.

ABI noted that twisted pairs will be an important local net technology, and it is offering voice and high-speed data simultaneously over a single twisted pair line. ABI also introduced a new letter-quality printer and a new family of advanced terminals geared to electronic mail and other office functions such as screen design, calendars and spelling checkers. ABI says it has lots of customers eager to use Net 1000, once the capacity is in place.

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• APPLE DEBUTS LISA. As expected, the new Apple micro goes after the high-end with an approach reminiscent of the Xerox Star. As such it marks a new direction for Apple and puts it at the forefront of today's user interface technology. The basic $9,995 price includes: the operating system and six application tools; a Motorola 68000 microprocessor and 1MB memory; a bit-mapped 12-inch display with a resolution of 720x360; a 5MB hard disk and two 860K floppies; a mouse a la the Xerox Star, and printer control software.

The two key selling points are integrated applications and ease of use. Apple is proudly claiming that an inexperienced user can start performing useful manipulations after a half hour's training. As for integrated software, Apple claims that data can be moved between applications -- text, numerics, graphics, etc. -- without rekeying. To help market Lisa to large organizations, Apple is beefing up its account executive staff, and it has hired former NAS president E. Floyd Kvamme to head up its marketing efforts. Lisa will also be sold through selected Apple dealers. Volume shipments begin in May.

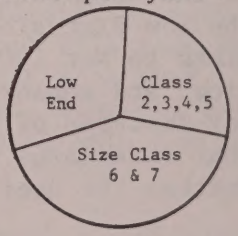
• CDC INSTALLS FIRST 33800. Beating both its PCM competitors and its own announced delivery date, Control Data shipped its first IBM-compatible 3380-type drive in December. CDC noted that it expects to produce 1,000 units this year, with the majority being delivered in the third and fourth quarters. For 1984 it expects production to increase "several fold."

• MICROELECTRONICS VENTURE NAMES PRESIDENT. CDC's proposed Microelectronics and Computer Technology (MCT) cooperative research venture has named retired Navy Admiral Robert Inman as its president and CEO. Inman has extensive experience with both the CIA and naval intelligence operations. Officially incorporated August 12, the MCT is expected to have an annual operating budget of between $50 and $100 million; it now has at least ten major participants.

• MAGNUSON DROPS 4300 REPLACEMENT EFFORT, STC DUMPS 3370. Two more black marks against U.S. PCMs; Magnuson has admitted that it just doesn't have the resources to go ahead with its planned follow-on to its 4300-compatible CPUs, while STC has given up on 3370 drives, saying the market isn't big enough.

• FUJITSU TO MANUFACTURE FIBER OPTICS IN U.S. By the end of the year, the number one Japanese mainframer will have three U.S. manufacturing plants, the other two being American Telecom (PBXs), and Fujitsu Microelectronics (chips). The new plant is expected to produce $100 million of optical cable per year.

• CORRECTION. Volume 18, No. 18, page 3. The size class 6 & 7 and size class 2, 3, 4, 5 sections of the 1986 pie chart should be reversed to look as follows:



1986

• APOLLO ANSWERS HP's CHALLENGE. Claiming the best price/performance in the scientific workstation market, Apollo has introduced a low-end version of its Domain series that answers HP's 32-bit 9000 desktop mainframe. For $10,000 in quantities of 50, the DN300 offers a 32-bit virtual memory Motorola 68010 with 0.5MB main memory, a 17" high resolution bit-mapped screen, a local area network interface and the Aegis operating system. Interestingly, no local storage is standard. Although a 34MB winchester is available, the emphasis is clearly on networking.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

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DAVID MOSCHELLA, EDITOR JAN. 14, 1983 • V/18, NO/18 P.J. MCGOVERN, PUBLISHER

IBM BUYS 12% OF INTEL; SIGNALS NEW ERA IN SEMICONDUCTOR COMPETITION

They should be very happy together. Intel needs money; IBM's got plenty. IBM needs chip technology; Intel is synonymous with semiconductor innovation.

The signs that theirs was to be more than just an important business relation have been there all along. Sales to IBM accounted for 13% of Intel's 1981 revenues, while IBM has steadily committed the entire low end of its product line to Intel-built microprocessors. Last March, when CDC President William Norris held the first meeting of his proposed joint semiconductor research project, IBM and Intel were the key no-shows, along with AT&T.

Thanks to the ever present fear of impending Japanese dominance, both Wall Street and the media have endorsed the move. What would have alarmed legions of antitrust watchers as recently as two years ago is now being seen as the type of cooperation American business "should do more of." Times change.

Whether IBM goes on to increase its share to the eight-year maximum of 30% is of secondary importance. After years of government-forced isolation, IBM is no longer afraid to wield its power; future acquisitions or buy-ins (Mitel?) suddenly look more plausible. Some other considerations:

- Will other chip makers follow suit? The list of the acquired is long -- Synertek, Fairchild, Mostek, American Microsystems. With its low stock price and poor earnings National Semiconductor now seems most in need of outside funding. In Japan, there is no such thing as a major independent semiconductor house.

- Key Intel 8086 users such as Burroughs and NCR are justly concerned, but given the amount of business IBM can guarantee Intel, IBM's needs would have inevitably influenced Intel's technological decisions anyway. Issues such as delivery schedules and information exchange may become more ticklish, however.

- The $250 million cash injection is roughly twice Intel's 1982 R&D budget, and nine times its 1981 net income. Given that the three-year semiconductor recession has yet to end, Intel's competitors must surely envy such a large financial cushion.

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THE IBM/INTEL CONNECTION

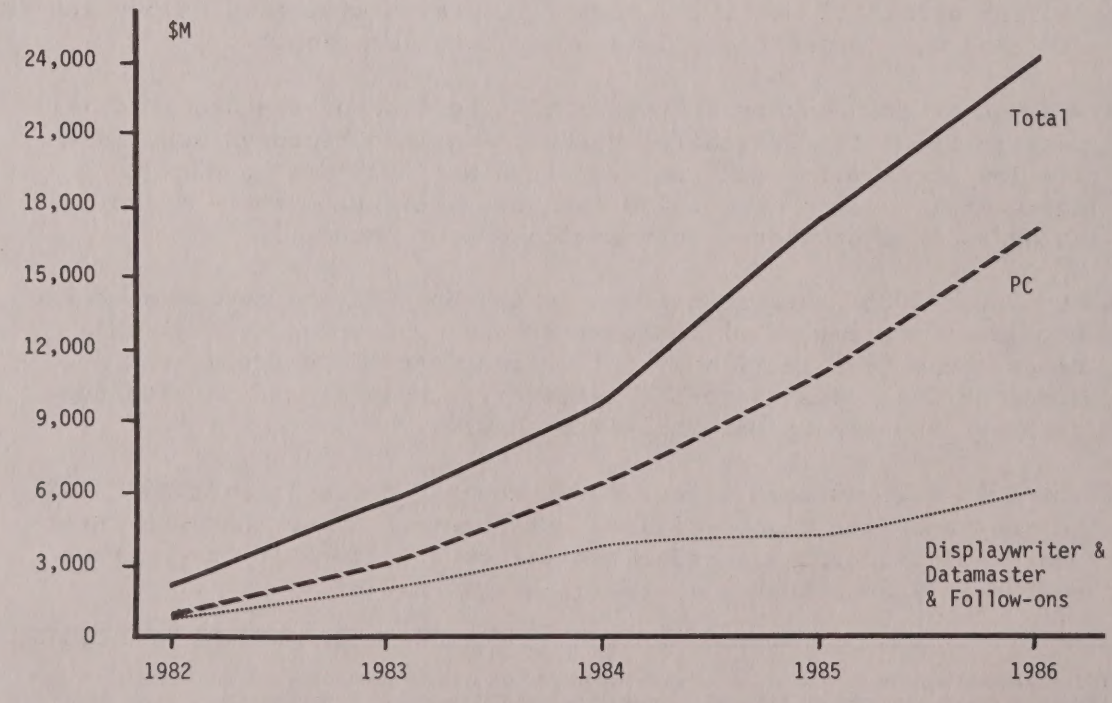
Product	Microprocessor	Est. Installed Worldwide 12/82*
Personal Computer	8088	200,000
Datamaster (S/23)	8085	30,000
Displaywriter	8086	95,000

* Figures are preliminary estimates. Additionally, IBM has already purchased Intel's 64K RAM data base tapes and the HMOS technology needed for manufacturing. Obvious future possibilities include the Intel iAPX 188 which is the upgrade for the 8088, and the iAPX 186 and 286, the follow-ons to the 8086. Bubble memory for personal computers and CMOS technology are other options.

A look at the size of the market for IBM's low-end products will show why IBM is so eager to assure Intel's ability to develop and manufacture products. Although EDP/IR recognizes that it is difficult to forecast market shares -- successful follow-on products, entrance of new vendors, Japanese competition, and manufacturing capacity are only a few of the difficulties -- if IBM can successfully hold its current market position for the Personal Computer and the Displaywriter, some staggering figures will accrue over the 1981-1986 period.

Some rough calculations by EDP/IR yielded a fairly conservative estimate that at today's prices over the 1981-1986 period some $25 billion worth of IBM shipments will be based on Intel microprocessors. This figure includes only PCs, Displaywriters, and Datamasters. The number would swell considerably if IBM chooses to use Intel microprocessors in the follow-on generation to its 3270 terminals or any new personal computers aimed at the home market.

VALUE OF WORLDWIDE CUMULATIVE SHIPMENTS, PCs, DISPLAYWRITERS, AND DATAMASTERS
(Copyright 1982 -- International Data Corporation)



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VALUE OF WORLDWIDE SHIPMENTS, IBM LOW-END PRODUCT VS. MAINFRAMES
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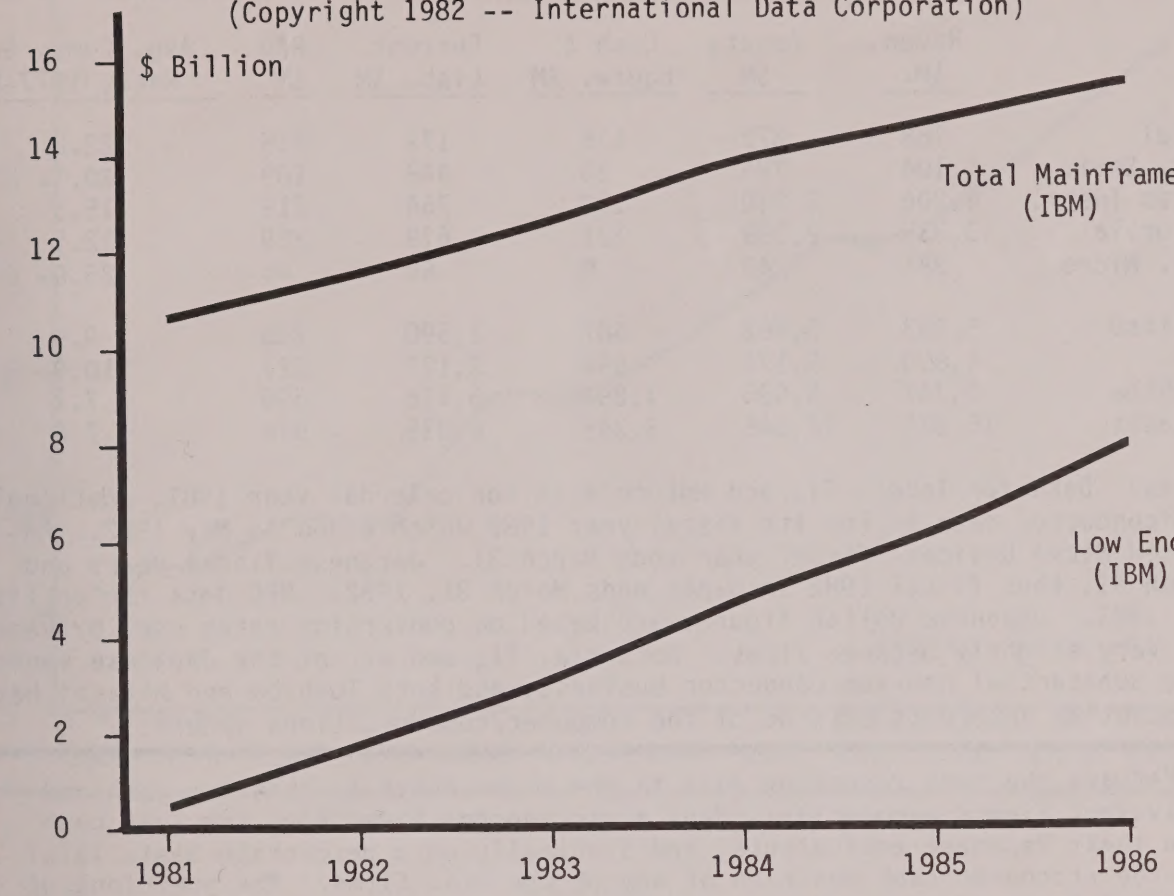
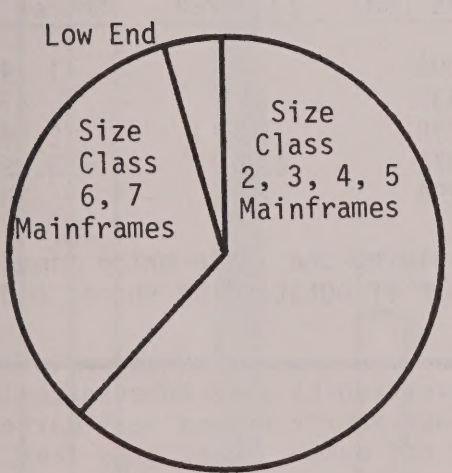
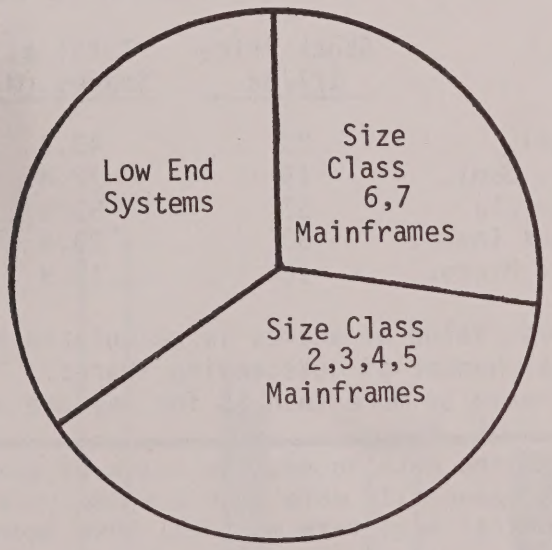


WORLDWIDE SHIPMENTS, LARGE MAINFRAMES, SMALL MAINFRAMES AND LOW-END SYSTEMS



1981 $11 Billion



1986 $23.4 Billion

Low end systems include PCs, Datamasters, Displaywriters and their follow ons.

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SELECTED DATA, MAJOR U.S. AND JAPANESE SEMICONDUCTOR MFGRS.

	Reven. $M.	Assets $M	Cash & Equiv. $M	Current Liab. $M	R&D $M	Avg. Comp. Gro. Rate, 1977-81
Intel	788	871	115	171	116	22.8
Nat. Semi.	1,104	785	10	448	109	20.3
Texas Instr.	4,206	2,310	150	764	219	15.5
Motorola	3,335	2,399	121	619	229	12.5
Adv. Micro	281	243	9	64	44	25.0
Fujitsu	3,253	3,482	587	1,590	278	9.9
NEC	4,820	5,174	598	3,127	227	10.9
Toshiba	9,747	9,095	1,894	5,716	390	7.7
Hitachi	15,871	16,845	3,345	8,835	599	7.0

Notes: Data for Intel, TI, and Motorola is for calendar year 1981. National Semiconductor data is for its fiscal year 1982 which ended in May 1982. Advanced Micro Devices' fiscal year ends March 31. Japanese fiscal years end March 31, thus fiscal 1982 in Japan ends March 31, 1982. NEC data is for fiscal 1981. Japanese dollar figures are based on conversion rates used by vendor and vary slightly between firms. Motorola, TI, and all of the Japanese vendors have substantial non-semiconductor business, and both Toshiba and Hitachi have substantial interests outside of the computer/communications sphere.

Perhaps the most revealing data in the above chart is that for cash and equivalent liquid securities. U.S. semiconductor firms keep far less cash than their Japanese equivalents, and ironically on a percentage basis Intel has the strongest cash position of any of the U.S. firms. The positions of National Semiconductor and Advanced Micro Devices look particularly troublesome given the industry's future capital needs.

VALUE OF SHAREHOLDER'S EQUITY, U.S. SEMICONDUCTOR FIRMS

	Stock Price 1/1/82	Total # Shares (M)	Value Shares ($M)	Stock Price 12/23/82	Value Shares ($M)
Intel	23	43.7	1,005	40	1,748
Nat. Semi.	19	22.8	433	21	479
Motorola	57	31.4	1,790	85	2,669
Texas Instr.	80	23.4	1,872	139	3,252
Adv. Micro.	16	15.9	254	25	398

Notes: Value of shares is calculated by multiplying the share price times the total number of outstanding shares. The number of outstanding shares did not increase by more than 5% for any one vendor.

As the data shows, the value of semiconductor stocks rose substantially in 1982, generally more than keeping pace with last year's strong bull market. Potential acquirers may well have been better off making their bids last January rather than today, although interest rates were considerably higher then. The one exception is National Semiconductor whose total stock value has remained virtually flat and is equal to only 61% of the book value of its assets. The figures for Intel, Motorola, TI, and AMD are 380%, 110%, 140%, and 163%, respectively.

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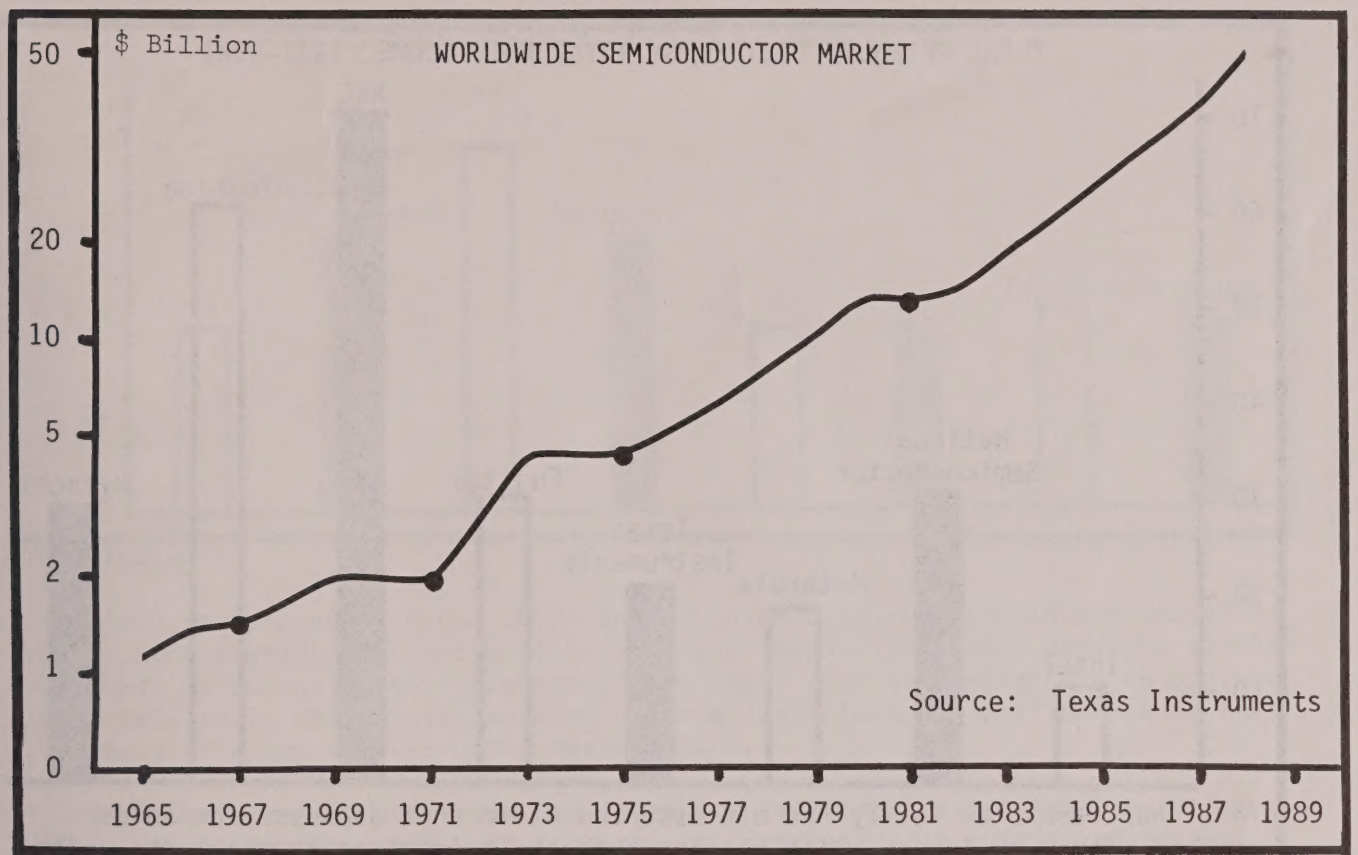

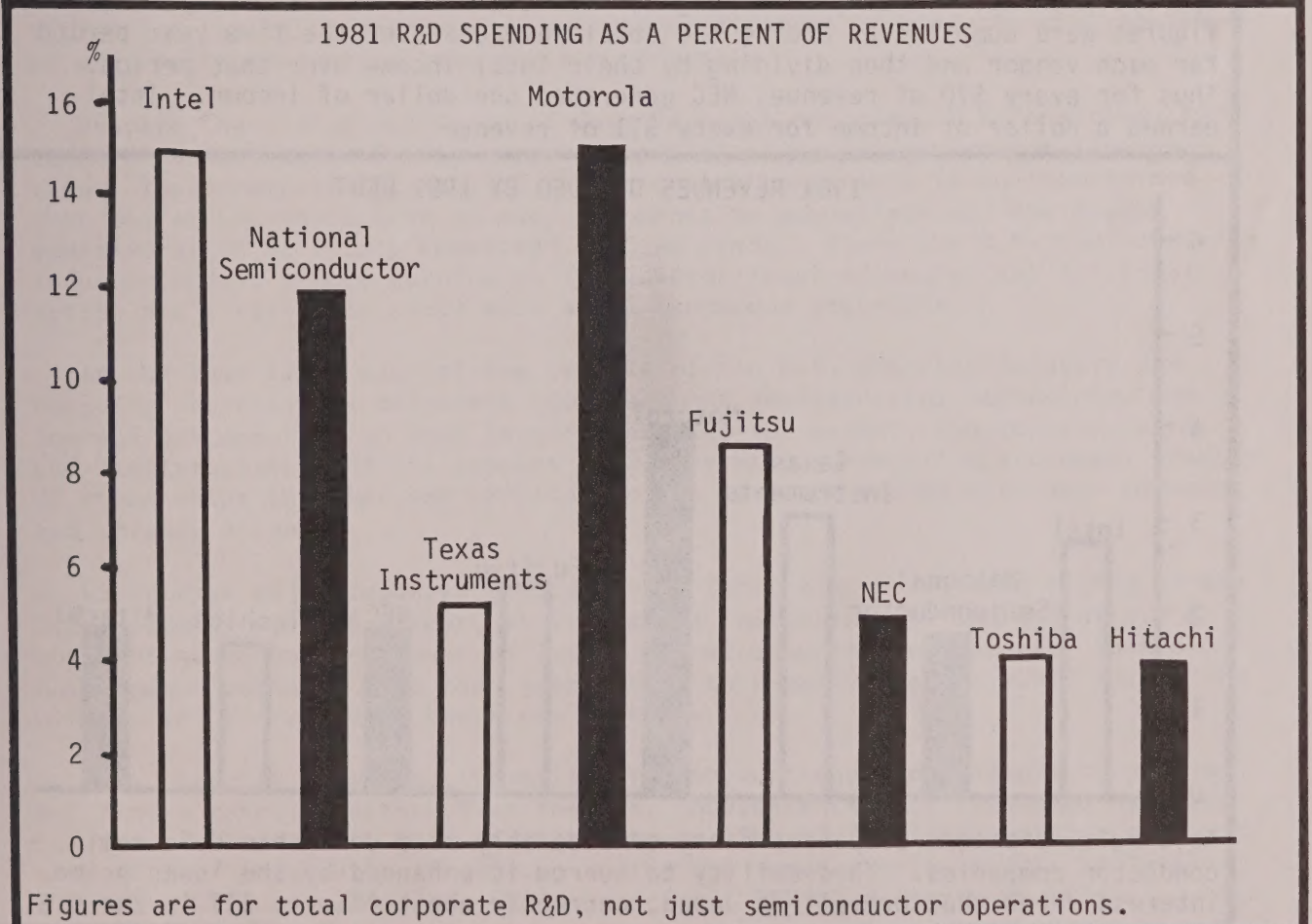

Figures are for total corporate R&D, not just semiconductor operations.

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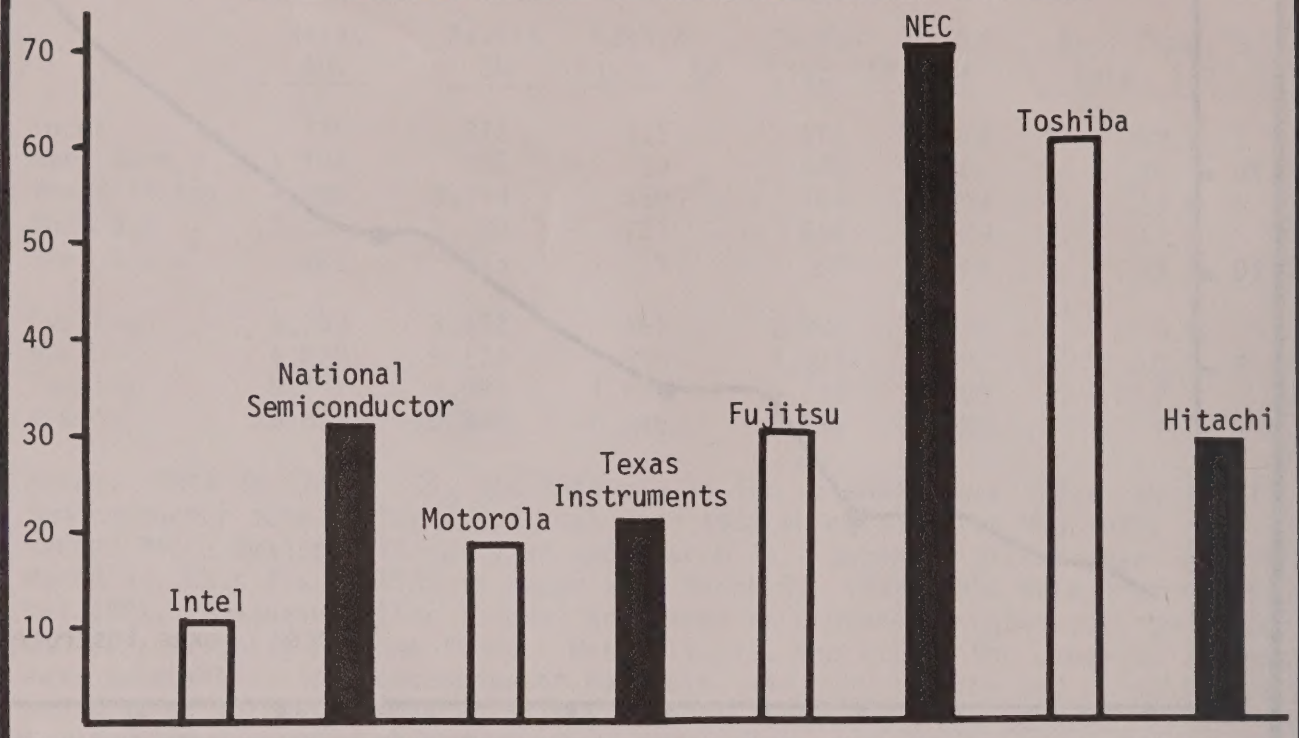
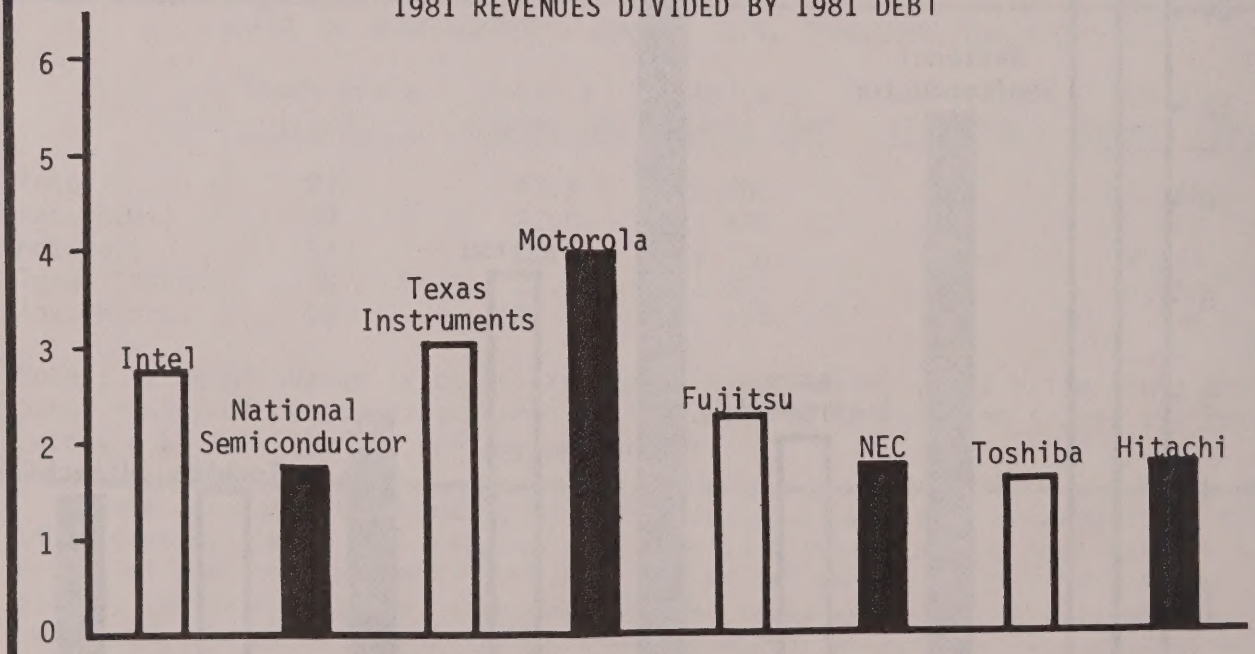
TOTAL REVENUES DIVIDED BY TOTAL NET INCOME, 1977-1981



This chart seems to verify the oft asserted claim that Japanese companies operate with much lower profit margins than their American counterparts. The figures were compiled by adding the total revenues over the five year period for each vendor and then dividing by their total income over that period. Thus for every $70 of revenue, NEC generated one dollar of income. Intel earned a dollar of income for every $11 of revenue.

1981 REVENUES DIVIDED BY 1981 DEBT



As a rule, Japanese companies carry considerably more debt than U.S. semiconductor companies. This ability to borrow is enhanced by the lower prime interest rates that prevail in Japan, currently about 6%, vs. 11% in the U.S.

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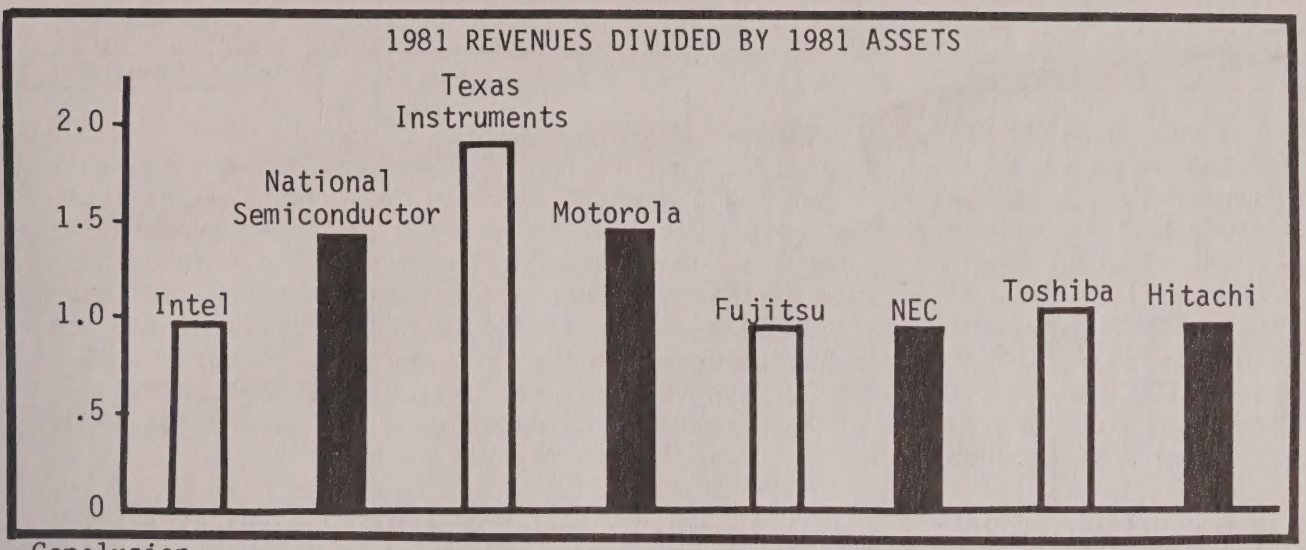

Conclusion

Given the preceding data, there is little doubt that American semiconductor firms have significant capital disadvantages compared to their Japanese rivals. Japanese firms can borrow more money at a lower rate and can afford to operate with relatively thin profit margins. These conditions are well suited to the Japanese strategy of increasing market share.

As the semiconductor market continues its inevitable expansion, most of these market factors will only increase in importance. Economies of scale, increasing capital requirements, and standardization of products will continue to make semiconductors a game for big players.

Despite the rising criticism of Japan's trade policies, U.S. semiconductor vendors cannot realistically expect to benefit from any government intervention. The international flow of semiconductor components is so intertwined that any action would have as many opponents as supporters and the Reagan administration is firmly committed to free trade. Since the U.S. semiconductor industry enjoys a huge surplus in its international accounts, any bilateral action vis a vis Japan could well set a dangerous precedent.

At the same time, many of the leaders of the U.S. computer industry are becoming increasingly dependent upon merchant semiconductor technology. As low-end systems take up ever larger shares of the market, the importance of the microprocessor and its support circuitry will necessarily increase. Supply of these chips thus becomes critical to the hardware vendor's product planning and revenue stream.

Given that major Japanese semiconductor firms also have their sights on the U.S. computer systems market, it is easy to understand why IBM and others do not want to become dependent on Japanese semiconductor technology. Such a development would be more than just a blow to company ego, it would loosen the U.S. firms' control over their own destiny.

U.S. computer firms and the military both want the independents to succeed, but from a resource perspective the U.S. independents look outgunned by their foreign rivals. Deals such as that between IBM and Intel can balance the competition, especially if IBM can resist the temptation to meddle in Intel affairs. Will we see more such cooperation? EDP/IR suspects we will.

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• NEC TO BRING FIRST MAINFRAME TO THE U.S. General Electric Service Co. (GEISCO) has asked Nippon Electric to ship one of its Acos 1000 mainframes for a year-long test against Honeywell's new DPS-88/81. The move is significant since Geisco and parent General Electric are one of Honeywell's largest customers. The NEC machine is roughly compatible due to the fact that for years Honeywell had NEC build some of its designs, an agreement that expired last year. NEC rates the Acos 1000 machines at 15 and 29 MIPS for its single and dual processor configurations; Honeywell rates its single processor DPS 88/81 at 7 MIPS, and the /82 at 13. Both vendors use Current Mode Logic (CML) chips. First deliveries of the Acos 1000 in Japan were in December of 1981. Honeywell's machines will not be available until late in 1983.

• DEC EXPERIMENTING WITH SCIENTIFIC WORKSTATIONS. Digital Equipment Corp. has established a small outpost in Los Altos, CA, known as its Western Research Lab. Staffed by some folk from Xerox's Palo Alto Research Center and others, members include Gene McDaniel, one of the developers of Xerox's Dorado engine, and Forest Baskett, known for VLSI work. Their charter is to design a high performance, personal scientific workstation, which DEC will then decide whether or not to manufacture. The idea is to build something substantially faster than a Vax 780 with floating point hardware and a bit-mapped color display. Although each user would have his own CPU, only the screen and keyboard will have to be in the individual's office, alleviating problems of space and noise. The team hopes to de-emphasize the role of hardware in system architecture and thus the system is likely to be programmed in a high level language. The group has very low visibility even within DEC.

• COMMODORE OPTS FOR Z8000. Commodore has decided to use Zilog's 16-bit Z8000 microprocessor as part of a future microcomputer line. Under the agreement, Commodore will be licensed to manufacture the Z8000 and peripheral circuits while Zilog will get manufacturing rights for certain custom circuits used in Commodore products. Commodore says it will be the first vendor to offer a 16-bit machine to the low end of the micro market.

• IBM SETS UP JAPANESE LEASING FACILITY. Beginning in January of 1983, IBM will set up a computer leasing company in Japan, expected to be named Computer Systems Leasing, Ltd. Capitalized at $12 million, the company will be jointly owned by IBM Japan (36%), Orient Leasing Company (35%) and Morgan Guaranty International Finance Corp. (29%). Orient Leasing is the leading Japanese third-party lessor. The organization will begin with 30 employees, and will put the leasing emphasis on the S/38, 4300 and 308X series of computers.

As such, the move closely parallels that in the U.S. between IBM Credit and Merrill Lynch, and fits in well with IBM's aggressive efforts to get leased and rental machines off of IBM corporate's accounts. In Japan, the move is also seen as part of a big effort by IBM Japan to retake the number one position in the market which it lost to Fujitsu two years ago.

The move will also help IBM Japan compete with the Japan Electric Computer Company (JECC), a government sponsored agency that has traditionally handled most of the leasing needs of Japan's six leading domestic firms. Recently, however, the JECC has wained in importance, and third-party leasing in Japan has picked up significantly. Some 75% of all mainframes in Japan are leased.

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● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

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MOLLY UPTON, EDITOR DECEMBER 22, 1982 ● VOL.18 NO.17 P.J. MCGOVERN, PUBLISHER

BURROUGHS ENTERS HIGH-END SWEEPSTAKES, STRESSES MEMORY AND I/O IMPROVEMENTS

The verdict on Burroughs' new 7900 varies with the vantage point. Compared to IBM's 308X series, the disks are smaller, the channels slower, and there is less system power. But compared to Burroughs' previous 7800, the I/O capacity is four times greater, the main memory up to 16 times bigger, and the space and power requirements have been halved. Perhaps the most accurate comment is that in terms of raw machine cycles, Burroughs has generally lagged a little behind IBM, and that with the 7900 that tradition has been maintained.

Because it uses powerful instruction sets and believes it has a superior mainframe architecture, Burroughs has never been a believer in throwing around MIP ratings. Indeed for the new 7900, the company is not even willing to compare the system to the superseded 7800, preferring to wait another month for more actual usage data to be available.

The company does say that the one, two and three processor versions of the 7900 are designed to compete with the IBM 3083B, 3081G, and 3081K, respectively. This would put the systems in the 6-15 MIP range, but since the primary improvements in the 7900 series have been in the area of I/O and memory, EDP/-IR suspects that internal CPU speeds are probably a little less than this. Burroughs also introduced two new disks, its first made by Memorex, but they do not use thin film heads and offer only 252 and 542 megabytes of storage, far less than IBM's two gigabyte 3380s.

Burroughs has a reputation for architectural pioneering and the 7900 series has some new wrinkles that distinguish it from the new IBM, Honeywell, and Sperry mainframe lines which have many similarities. Among them:

- More memory. The 7900 series can accommodate up to 96MB (at $25,000/MB) of main memory in a single processor system.
- Air cooling. The 7900 is totally air-cooled and Burroughs says that it will not move to liquid cooling in the foreseeable future.
- An auxiliary processor. In addition to multiprocessing capability, all 7900s come with an attached Burroughs 5900 that is code compatible with the 7900. It off-loads CPU tasks and handles testing.

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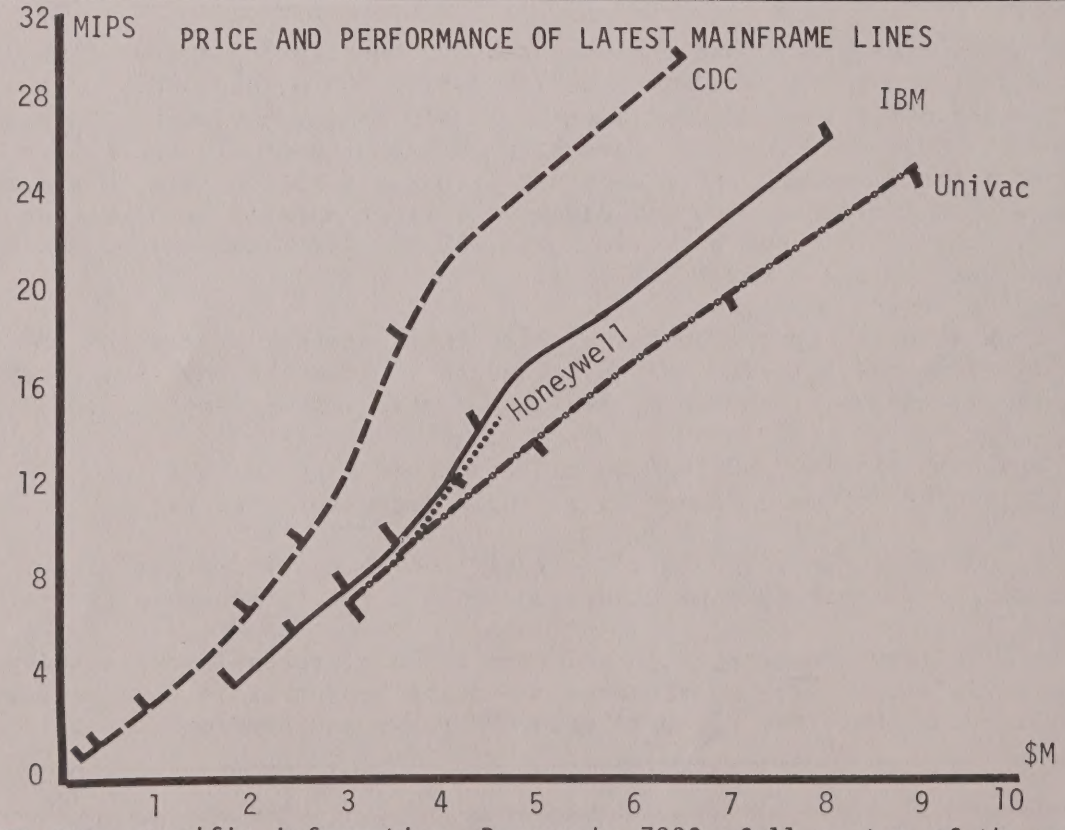
FEATURE COMPARISONS, LATEST MAINFRAME LINES

	IBM 308X	Univac 1100/9X	CDC 8XX	Honeywell DPS/88	Burroughs 7900
MIPS Range	4-27	7.5-25	1-30	7.2-13	6-15?
Addressing	24/31	18/24	21	26/43	20
Logic Chips	TTL	ECL	MOS	CML	TTL
Cache	64K	64K	4K	64K	NA
Max. Memory	64MB	64MB	2MB	64MB	96MB
Memory Chips	16K	64K	64K	64K	64K
Disk Size	2GB	2GB	1GB	1GB	.5GB
Max. Channels	24	40	12	40	24
Transfer Rate MB/sec	.3	4.3	4.5	1.5	1.3
Cooling	Water	Water	Freon	Water	Air
# of Models	6	4	7	2	3
Available	4Q/81	2Q/83	2Q/82	4Q/83	3Q/83
Price Range $M	1.3-8	2.8-10	.2-6.4	2.8-4.8	2.5-4.5

Notes: Univac, CDC, and Honeywell MIP ratings have been supplied by the vendor; IBM figures reflect IDC's estimates. Burroughs MIP figures based on that company's comparisons of its machines with certain IBM machines. EDP/IR cautions that MIP ratings are rough estimates at best, and can vary greatly among different tasks. CDC's main memory consists of 60-bit words; the other vendor figures are for 8-bit words. Disk capacity is based on per drive capacities. Cache and channel data is for single system configurations. Honeywell has promised two more models in its DPS/88 family; some members of the CDC family will not be available until first quarter 1983.



Pending more specific information, Burroughs 7900s fall on top of the second, third and fourth machines in the IBM line.

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It has now been about two years since former Treasury Secretary W. Michael Blumenthal took over the reins from Paul S. Mirabito, and as promised Blumenthal has implemented a number of changes to help overcome Burroughs' traditional problems of inefficient manufacturing and poor customer service.

Two years ago, Blumenthal said that he considered application software and industry-specific solutions to be one of the cornerstones of Burroughs' future strategy. But although the company has followed its mainframe brethren in making overtures to third-party vendors, vertical marketing strategies have not been a prominent part of the company posture over the last 24 months.

In fact, the 7900 announcement lacked any specialized features. Burroughs merely said the new system will be used by its traditional base of utilities, financial institutions, health care facilities, government agencies, and large business and industry. If there is a message, it is that the 7900 is geared to data-intensive industries, not those commanding large numbers of CPU cycles; the most eager customers will be those that are either memory or I/O bound.

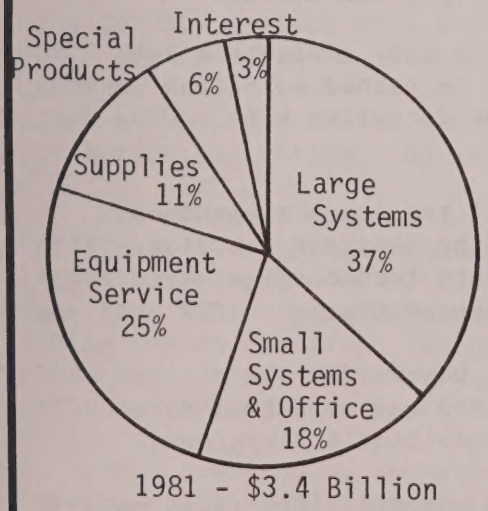
Perhaps in an effort to guarantee delivery dates, Burroughs has kept the technology simple. It is not using the type of modular logic packaging found in IBM thermal conduction modules or Honeywell's micropackages. It has, however, improved the densities of its rack-mounted boards. A spokesman said that using the company's Multiwire technique, printed circuit board densities have improved four to six fold; this has enabled the size and power cutbacks.

BURROUGHS FINANCIAL PERFORMANCE, 1977-1981

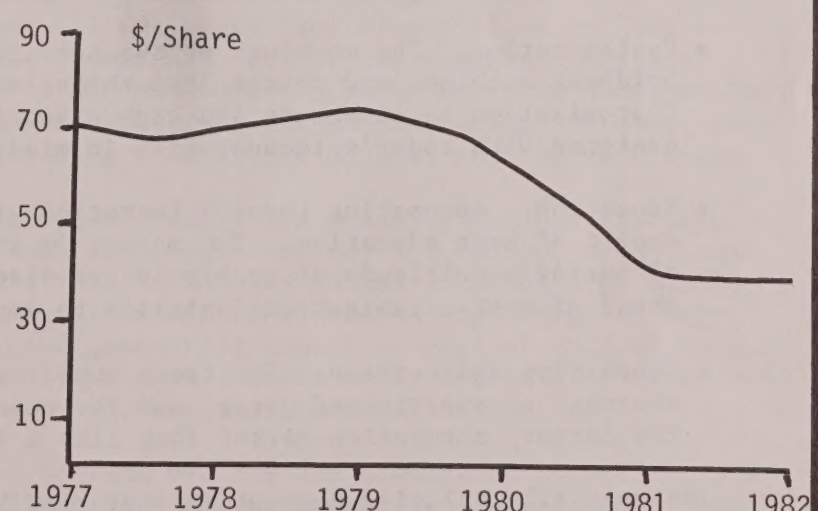
	1982*	1981	1980	1979	1978	1977
Revenues $M	3,065	3,405	2,902	2,830	2,460	2,126
Current $ Rev.**		3,405	3,203	3,547	3,429	3,191
Net Earnings	99*	149	82	306	253	215
Assets $M		4,439	3,854	3,297	2,861	2,607
Return on Assets		3.3%	2.1%	9.3%	8.8%	8.2%

*Nine month figures. **Numbers are expressed in 1981 dollars.

BURROUGHS REVENUE BREAKDOWN*



BURROUGHS STOCK PRICE



*From Burroughs' 1981 annual report

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RECESSION PUTS THE BRAKES ON FACTORY AUTOMATION SPENDING AS SUPPLIERS TRY TO EXPAND MARKET ANGLES AND NICHES

With excess factory capacity at its highest level (32%) since the depression and with new factory construction at a virtual standstill, now is not the easiest time to sell factory automation equipment or sing the praises of the factory of the future. Throwing high-priced capital at an old plant already under-utilized is often a less than tempting management alternative.

Yet, perhaps because some type of industrial automation seems both essential and inevitable, swarms of vendors from many different backgrounds are positioning themselves for what they see as a steadily expanding market for factory automation equipment and services.

The market is already substantial. International Data Corporation estimates that in 1981 the sale of factory automation equipment in the U.S. reached $8.1 billion. The figure includes CAD/CAM systems; process control systems; robots; MRP systems; programmable controllers; numerical control systems; general-purpose computers sold into factory automation environments, and associated services and software. The task at hand is to both integrate and build off of this considerable base of equipment.

Despite the complex terminology and the haze of acronyms -- CIM, CAM, CAD, CAI, etc. -- the market forces that are shaping the industrial automation market are readily familiar to those used to the commercial side of the DP business. Among the key issues, trends, and concerns:

- Different vendor approaches. Hardware, software, service bureau, and turnkey solutions are proliferating as are mainframe, mini, desktop, and intelligent workstation options. In addition, there is a real schism between the shop floor factory types and those with a sophisticated computer graphics background.

- Market niches. Just as few companies are buying the full automated office concept, even fewer factories are leaping into the factory of the future. Despite the visions of companies such as General Electric, factory automation remains a piece-by-piece affair.

- Customization. The workings of the average factory resemble a Rube Goldberg machine, and do not lend themselves to canned solutions. Customization requirements are high since few factories were designed with today's technologies in mind.

- Education. Automating today's factories will require a tremendous amount of user education. The market is in the familiar position of having a multitude of sophisticated discrete technologies way ahead of most organizations' ability to implement them.

- Consulting and service. The fresh supply of buzzwords, the shortage of experienced users, and the need for customization makes the factory automation market look like a consultant's playground.

The most all-inclusive concept is that of CIM, computer integrated manufacturing. CIM encompasses all major aspects of the manufacturing process -- design, analysis, drafting, simulation, machine control, process planning,

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robotics, MRP, shop floor monitoring, quality assurance, and quality control. It is, therefore, much wider than the CAD/CAM market which is primarily concerned with the relation between design and manufacturing specifications.

Different approaches

The recent Autofact IV conference in Philadelphia provided a good opportunity to see all the major factory automation approaches under one roof. No one strategy is dominant, but because of the complexity of this market, EDP/IR believes that a consulting/service capability will be essential for long term success in the Fortune 500. Given the changing hardware technologies and market perceptions, it is not surprising that many processing services vendors such as Geisco, McAuto, and others have done well in the manufacturing market.

Computer vendors such as IBM, Prime, Sperry, DEC, Apollo, etc. all provide powerful processors that work with third party software. In general, the computer system vendors seem content to provide enough support to keep their installed base in the fold, while leaving users with the task of gluing their systems together; they provide tools but not necessarily solutions. These vendors have, however, become much more aggressive over the last year or so.

A hot subset for the computer systems vendors is the market for workstations. HP has recently followed the path of Apollo, selling individual workstations with the power of a Vax minicomputer. Prime has a new Electronic Design Management System (EDMS) which enables the user to carry out the entire design function (for printed or integrated circuits) from a single station. The prices, often in the $75,000 to $100,000 range, are still a little high; getting them down into the $20,000 range would greatly expand the base of potential users, such as junior draftsmen.

On the services side, the market will continue to be dominated by remote problem solving functions although as more factory data collection takes place, transaction processing expenditures are steadily increasing. Processing services claim about 70% of the manufacturing market's value-added dollar, but the share held by packaged software and turnkey systems is steadily rising.

IDC forecasts that the U.S. market for manufacturing software, services and turnkey systems will grow at 27% per year, from $1.4 billion in 1981 to $4.8 billion in 1986. As in the commercial side of the business, service companies must seek out new forms of value-added. Xerox Computer Services has just announced a system designed to integrate its manufacturing, finance, distribution, marketing, and engineering information modules for IBM mainframes.

The computer systems and services vendors are steadily making life more difficult for CAD/CAM vendors such as Computervision, Intergraph, Calma, and Applicon. These companies are strong in the design and graphics area but do not have wide experience in other areas of the manufacturing process. Anything beyond drafting, design, and generating numerical control (NC) tapes has been outside of their scope, and they have traditionally depended on users and third-party software developers to produce any CIM capabilities.

This position is changing. CAD/CAM vendors are now moving toward the CIM market by providing interfaces for their CAD equipment to other vendors' CAM and manufacturing control gear, slowly allowing their installed base to choose among the new CIM options; the CAD/robotics area seems particularly active.

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CAD/CAM vendors are also being moved toward CIM by market forces. Both Calma (GE) and Applicon (Schlumberger) have been bought by firms wishing to address the total factory automation market. Schlumberger, which also has bought Manufacturing Data Systems, has a significant part programming capability that gives Applicon a leg up on other CAD/CAM vendors.

Computervision is the only one of the CAD/CAM firms that actually makes its own hardware. The others typically use a Vax and then concentrate on software. EDP/IR thinks that Computervision ($320 million in revenues for the year ending September 1982) will inevitably find it difficult to keep pace with the price/performance offered by the computer systems vendors. Factory automation tasks consume lots of CPU cycles and Computervision's delay in getting its new 32-bit machine out the door has already hurt them some.

Perhaps recognizing this issue, Computervision made show headlines by purchasing Cambridge Interactive Systems, developers of Medusa, a three-dimensional design and modeling package that Prime has had success in marketing. The move marks Computervision's entrance into the third party software market, although Prime retains exclusive marketing rights for Medusa through 1985.

Despite its problems, however, Computervision is still growing faster than its competition, and because of its preeminent image and its considerable installed base, it is well positioned for future growth and opportunities, either on its own or through joint ventures.

Coming from a different angle are the numerical control and factory floor experts -- Gould, Allen Bradley, and to some extent General Electric. These folks -- there are some 35 vendors of NC equipment alone -- have the advantage of understanding the "heavy metal" machine tool mentality that often resents or even rejects solutions imposed by the CAD engineers.

Gould seems committed to the automated factory concept. It has over the last few years stripped away many of its older industrial lines, and is concentrating on electronics. Its Modicon subsidiary is the leading supplier of programmable controllers, and its SEL division makes superminis suited to CAD/CAM and manufacturing process control applications. Allen Bradley hopes to similarly build off of its strong position in the numerical control market.

Since at this time the market consists of many niche suppliers trying to hold onto and expand their territory, EDP/IR provides this brief list of some of the areas that seem most active.

- Geometric and solids modeling
- CAD graphics used in NC programming
- Moving part simulation (kinematics)
- Low-cost programmable controllers
- Robots with vision and other sensing systems
- Engineering workstations
- Manufacturing cell simulation
- Redundant systems
- Local area networks

But in almost all areas caution is the word. The majority of factory automation equipment is sold to "smokestack America." And as long as smokestack America continues to struggle, capital spending will sputter, investment tax credits and accelerated depreciation schedules notwithstanding.

Contributing to this article was Ralph Finos, an IDC consultant in the factory automation market.

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1982 -- YEAR OF THE DESKTOP; MULTIFUNCTION DEVICES TO TRANSFORM LOW END OF THE MARKET

Despite the recession and the settlement of two major antitrust suits, 1982 was clearly the year of the desktop. Not only has just about everybody brought out some sort of personal workstation, but the shift toward desktop computing is affecting the entire industry both technologically and financially. Even the venerable mainframe market has had to make room for micros.

The minicomputer, the word processor, the small business computer and the data entry terminal are four machines whose future will be altered by the availability of low cost microprocessor technology. Word processing, data entry, graphic display, and data processing are steadily being transformed into software applications, capable of running off a single desktop engine.

While reshaping old markets, the desktop is also kicking off new ones. The microsoftware market, almost non-existent just two years ago, has exploded. Vendors are rushing to build smooth ties between micros and mainframes, while the number of 5.25" winchesters and 3" floppy start-ups increases weekly. The Japanese are making hay with low-cost printers. But desktops weren't the whole story; new interest in the office, new mainframes, and an unchained AT&T also helped take minds off of the recession. Some of this year's highlights:

IBM. Antitrust suit dropped; reenters services business; enters robotics market; forms leasing subsidiary; endorses field upgrades; aggressive pricing and volume discounts; moves to increase purchases, earnings rise; teams up with Mitel for PBX know-how; obsoletes 303Xs; introduces MVS/XA and four processor 3084; begins to dominate personal computer market.

PCMs. Japanscam scandal rocks industry; bad year financially for Amdahl; Magnuson almost goes under; Amdahl enters peripheral market, NAS expected to follow. STC enters 4300 market. Disk vendors slow to bring out 3380 drives.

Bunch. Univac, Honeywell, CDC, Burroughs respond to IBM 3081; Univac enters office market; NCR enters OEM computer and merchant semiconductor markets; Burroughs and NCR hawking Convergent gear. Big layoffs at Honeywell and Univac.

Minis. Growth slows. DEC enters PC market; HP first to implement 32-bit microprocessor; DEC, DG, Prime extend 32-bit superminis downward; DEC, DG, HP move after office market; mini shipments flat; redundancy gains acceptance.

Communications. AT&T divests telcos; forms Net 1000; antitrust suit dropped. Digital termination systems, cellular radio, local networks, voice store-and-forward, and voice/data PBXs gain interest; new packet switching vendors.

Semiconductors. CDC proposes joint semiconductor research plan; microprocessor marketing war -- 8086 vs. 68000; Japanese dominate 64K RAM market; lots of layoffs, shutdowns and wage freezes; profitability sags.

Miscellaneous. Dozens of 5.25" winchester disk entrants; optical disk products hit market; impressive start-ups -- Grid, Fortune, Stratus, Synapse; recession batters industry, unparalleled layoffs; channels of distribution emerge as key issue; technology theft becomes hot issue; memory prices fall to $5,000/MB; Datapoint, Xerox, Exxon, Magnuson stumble; France nationalizes key vendors; Japanese enter supercomputer race, but micro attack flops, so far.

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• SPERRY BUYS INTO MPI. Everybody's trying to get a share of the limited thin film expertise available. Sperry will exchange its Information Storage Systems division for an undisclosed portion of Magnetic Peripherals, currently owned by CDC (70%) and Honeywell (27%). Although the new disks introduced with Sperry's 1100/9X series match IBM's 2GB drives, they don't use thin film heads. About 1,800 Sperry employees will be transferred to MPI, which currently employs 9,000 workers. With the exception of NCR, the move will unite much of the Bunch's thin film efforts. MPI is the majority owner of Peripheral Components, Inc., a joint thin film venture with Memorex now owned by Burroughs.

• ADP PICKS ALTOS FOR MICROS. Major service bureaus continue to sign large OEM agreements with personal computer vendors. In a contract estimated to be worth $10 million, ADP's Network Services division will use Altos 8-bit and 16-bit desktops, the latter to be equipped with the Xenix operating system, a version of Unix. Tymshare, Xerox, and Geisco have also announced personal computer contracts, but the ADP deal is the first to use a Unix type of operating system and a multi-user, multi-tasking product.

• IBM ADDS DISPLAYWRITER, SYSTEM/34, PLASMA DISPLAY TO OEM LINE. Until now, IBM's OEM efforts have centered around relatively mature products, but the availability of a 3"-thick bit mapped 17.2" diagonal plasma screen indicates an intention to make advanced products available as well. Described by IBM as an electronic blackboard, the orange-on-black high-resolution screen is flicker free, requires no external refresh and can be divided into separate sections. IBM sees the 581 plasma display being used in tasks where either space is restricted or mobility is required. The 581 is now available for evaluation. IBM also introduced a $100,000 drafting system, the 7361. The price includes two 3251 graphic display stations, one 3101 terminal, and a color plotter. The Fastdraft System will be available in May of 1983.

• KVAMME CALLS IT QUITS AT NAS. After fifteen years at National Semiconductor, National Advanced Systems president E. Floyd Kvamme (45) has resigned for what is being described as "personal reasons." Executive vice president David Martin (37) has been named as successor.

• ROLM GETS INTO VOICE MAIL GAME. Joining IBM, Wang, Univac and others, Rolm is offering voice store-and-forward on its entire CBX line. Available in June, the system has the usual features -- distribution lists, message indicators, acknowledgements, etc. Prices start at $50,000, and Rolm says that its $70,000 system is at least 40% less expensive than any competitive system.

• NCR FINDS FIRST DISTRIBUTOR FOR TOWER 1632. First Computer Corp. is NCR's first OEM CPU customer, expected to buy $10 million worth of NCR's Motorola 68000-based Tower 1632.

• ICL BREAKS INTO THE BLACK. After almost two years of losses, Britain's International Computers Ltd. has posted a modest $19 million profit for its fiscal 1982. Last year, the company lost some $215 million.

• IBM CUTS 3380 PRICES. In a continued effort to spur purchases, IBM has cut 3380 and 3880 purchase prices by 15%, while offering volume discounts of 6% to 12%. The PCMs won't begin volume shipments of 3380s until mid-1983.

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● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

MOLLY UPTON, EDITOR DECEMBER 1, 1982 ● VOL.18,NO.16 P.J. MCGOVERN, PUBLISHER

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IBM, SPERRY UNIVAC ADD NEW OFFICE FEATURES AS ERA OF INTEGRATED SYSTEMS MOVES CLOSER

Over the next five years, the marketplace will determine what the role of the mainframe will be in the automated offices of tomorrow. Not surprisingly, IBM, Sperry Univac, Honeywell, and Burroughs see the general-purpose CPU as an essential part of integrated DP/WP systems, manipulating data bases, handling communications, and storing, formatting, and printing documents.

Recently, IBM and Sperry Univac made major office announcements. Since the two vendors are coming from different strategic positions, the details differ, but the goal is the same: viability in the marketplace. With the latest announcement, EDP/IR thinks IBM is downplaying the role of its 8100 as a distributed node for office applications. Now, many devices are encouraged to hook directly to a host, which performs functions such as filing and retrieval as well as advanced functions such as document conversion. Sperry Univac, however, endows its DOPS-10 node with electronic mail and other capabilities.

IBM promised to integrate its diverse office gear back in June of 1980, but because that equipment is incompatible, the task is massive. Sperry Univac, on the other hand, has the advantage of coming in with a reasonably clean slate, and takes a tack similar to Honeywell's. Other mainframe office trends include:

- Intelligent workstations. The IBM PC and Displaywriter can communicate with 370, 8100, and 5520 type equipment. Sperry Univac's new workstation is an upgraded Z-80-based UTS 40 terminal. Honeywell's Infowriter looks like a DPS/6.

- An emphasis on PBXs. IBM is working with Mitel; Sperry Univac with Northern Telecom. Honeywell acquired Action in 1981. Sperry Univac joins IBM and Wang in the voice store-and-forward business.

- Electronic mail. IBM has a new store-and-forward fax system, the Scanmaster I. Sperry is providing links to Western Union's sophisticated message systems.

- Access to central data bases. Workstation access to mainframe data is one area where the mainframers should have an edge over Wang.

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Strategy overview

Although it is hardly surprising that mainframe vendors tend to come up with mainframe solutions, IBM's renewed reliance on the 370-type host makes the DDP node begin to look superfluous. Although workstation connections to an 8100 can be passed through to the host, there's little advantage to going through an 8100 if one has a Displaywriter or 5520 and doesn't need the 8100's version of WP. In the IBM system, all document conversion takes place at the host. Sperry also allows direct connection of its workstation, the Desk Station, to a host, but one can gain departmental functionality by using a DOPS-10, which is a BC-7 small business system with new innards that give it file compatibility with the 1100 host.

IBM's product plans in the office remain uncertain. The company is committed to making the old gear compatible to a greater degree, but EDP/IR believes that IBM would prefer to bring out a new line of more compatible products. The conversion and formatting necessary for the existing equipment adds a lot to the system overhead: Disoss alone requires 600K bytes virtual storage and 3.3M bytes of disk.

Steep price cuts (17% to 33%) on the 5520 are probably more due to competition than impending obsolescence. Not coincidentally, the cuts, coupled with additional capabilities such as attaching the PC, make the 5520 look more important in the scheme of things. The 8100 continues to sell and have some large customers, although it does not look like the DDP cornerstone many thought it would be. IBM's reluctance to put text functionality on the DPPX version may be a clue that it is rethinking the 8100's place in distributed office functions.

IDC estimates that there are now some 4,000 8100s installed in the U.S. and about 9,000 worldwide. Best estimates are that the operating systems, DPPX (user programmable) for data processing, DPCX (central site programmable) for text and data processing, are split almost equally, with DPCX having a slight edge. As for the 5520, IDC estimates there were some 8,000 5520 workstations in use in the U.S. at yearend 1981.

At this point all that is clear is that intimidating terms such as MVS, SNA, SDLC, etc., are about to become a key part of the office automation solution. The IBM strategy appears to pave the way for the MIS manager to assume control over office systems strategy.

Sperry Univac believes the office side of the market will become extremely important, and calls Sperrylink "critical" to the company. At the introduction, a Sperry Univac vice president predicted Sperrylink sales of $1 billion over the next five years from the 1100 base. He added that first day orders were $20 million. Following an approach the company has used in the manufacturing area, Sperry has set up an in-house consulting group to help large customers define their needs.

The Sperrylink hardware is low tech. Z-80-based desktops connect to the DOPS-10 that basically acts as a traffic cop providing storage, electronic mail and scheduling functions. Each workstation has its own intelligence for applications such as Sperry word processing or desktop computing (CP/M); there is no Sperry spreadsheet program yet.

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PRIMER ON IBM OFFICE LINGO

DISOSS, PROFS, DOSF, DLF ... In order to make sense out of IBM's office capabilities, one has to digest a whole new set of acronyms that make some of their DP brethren look simple. Since the new announcements assure that the above terms won't go away, EDP/IR offers some definitions.

Document Content Architecture (DCA) and Document Interchange Architecture (DIA). By next June, IBM has promised to release the specifications on its system architecture, akin to the manner in which it let folks develop SNA-compatible products. The DIA will provide the rules for delivering documents, i.e., the "envelope" aspect, in an IBM network, while the DCA will describe how to handle the content of the document, the "letter," complete with all elements of the "compound document": text, data, graphics, image (non-coded information) and voice.

There are three ways to interchange documents:

- Communications, wherein much of the formatting is usually lost;
- "Final form," wherein the screen and/or print image resembles the original format but one cannot edit it;
- "Revisable form," which allows editing by a system that's different from the originating system. The recent IBM announcement focuses on facilitating distribution of final form documents.

Distributed Office Support System -- Disoss. Supported by MVS and DOS/VSE, Disoss is the tar that paves the road for document distribution between systems and it supports library services on the host. Whereas previously it allowed the 8100 DPCX to link with it, it now will link with the 5520, the Displaywriter, and the new Scanmaster I. (The DPPX has to piggyback off a DPCX in order to get Disoss services.)

The new Version 3 is supported only by CICS whereas previous versions could run either CICS or IMS. Thus, IMS users are left out. The new version allows user-written CICS programs to access Disoss document-related functions. The software charge on MVS is $1,300 month after a $4,000 initial charge.

Professional Office System -- Profs. The only mainframe office software aimed at the VM side of the house has been upgraded to regular product status. Profs provides document distribution, search and retrieval capabilities, and spelling, calendar and scheduling features as well as more advanced features such as phrase checking, context checking and synonym generation. Available in August 1983, the software charge is $600 per month after a one-time price of $4,000.

Distributed Office Support Facility -- DOSF. Works under the 8100's DPCX operating system to provide office features such as spelling, hyphenation, formatting, and merged documents for mass mailings. DOSF is needed to take advantage of Disoss features. The software charge is $621/month.

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With these definitions out of the way, the flock of recent IBM announcements can be summarized as follows:

- The Scanmaster I Image terminal. Basically a store-and-forward system designed for SNA operation that can, with optional attachment, function as a Group II fax. It's another indication that IBM is serious about handling images in its compound document. (The 3800 recently got the capability to create graphics, although software is lacking.)

  The Scanmaster I can also serve as both a printer and copier. It is manufactured by IBM at its Austin, TX, plant, but uses sub-assemblies made to IBM specifications by Toshiba. The Scanmaster I operates under Version 3 of Disoss. Three models are available, priced from $11,800-$14,800; shipments begin in March. Volume discounts are available, as is financing through IBM Credit Corp. (The majority of facsimile machines on the market are leased or rented.)

- Profs promoted from an RPQ to licensed program product.

- The 5520, Displaywriter, Scanmaster I, connect to Disoss.

- No more leases on 5520s, purchase and rental only. Prices on 5520s cut 17% to 33%.

- The PC can now be part of a 5520 cluster, emulating the 5520's 5253 terminal and acting on its own at other times.

- The PC can connect to the 8100 DPCX via 3270 or 3101 emulation (it can also hook to a DPPX).

- Limited document transfer between the Displaywriter and VM/CMS, so that Profs and Displaywriters can work together.

- Two new letter-quality printers, 40 and 60 cps; and the 8100 can use these as remote printers.

- DOSF on the 8100 is enhanced for ease of use.

- Two new electronic typewriters, the 65 and 85.

The trend is clearly toward integration of both systems and workstations. The immensely popular PC and the reasonably successful Displaywriter are taking on the capabilities of not just 3270 terminals, but 8775s and 5253s. Documents prepared locally can take advantage of certain mainframe strengths such as indexing, distribution, and access to high-speed printers.

Full interconnectivity has yet to be achieved, however. With this announcement, the revisable form capability will be possible on text between Displaywriters, generally via host connections, and on records between the Displaywriter and 5520. A Displaywriter can retrieve a final form 5520 document.

IBM said it intends to have revisable form text interchange between the 5520 and Displaywriter via Disoss/370 and SNA point to point communications.

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One tube should do it all

One of these days, a vendor of desktop computers will come up with word processing software that comes close to that of the standalone word processor. Whoever does it first should be a big winner, because despite all that talk of Visicalc and access to corporate data, word processing remains the primary desktop computer application. This is especially noteworthy given the lack of low-cost letter-quality printers.

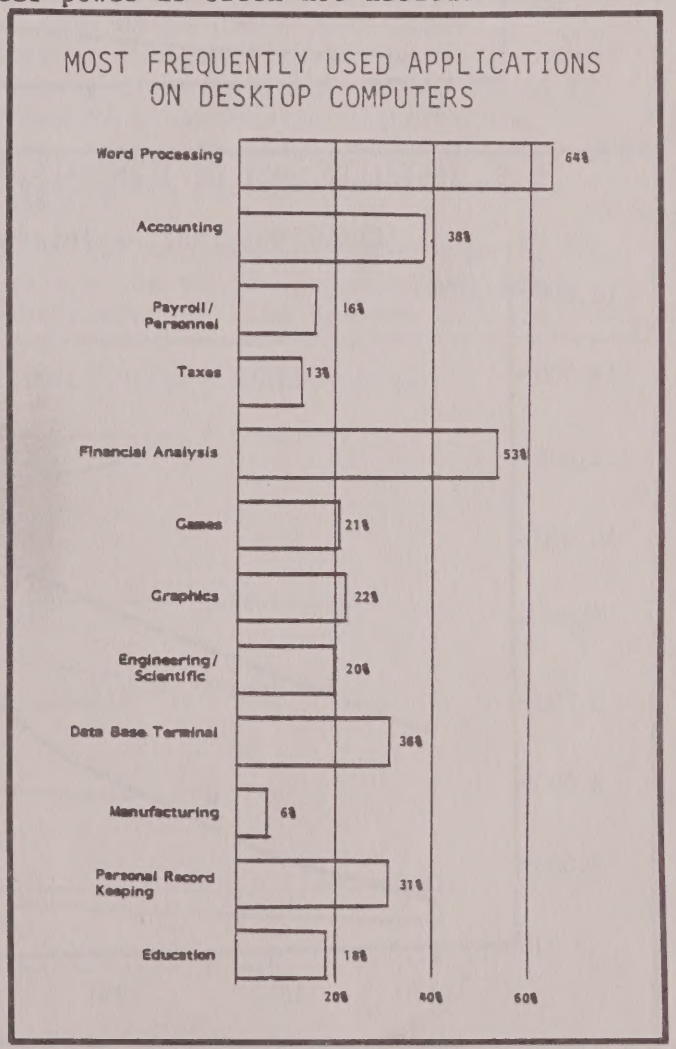
A recent IDC survey of desktop computer users revealed that 64% had word processing software and 18% of the buyers considered word processing the primary application. Finance (16%), accounting (13%), education (13%), and engineering (10%) followed. The most frequently used features are shown in the chart below.

If one extrapolates these percentages to IDC's overall desktop computers, it becomes clear that more desktop computers are being shipped for word processing functions than are standalone word processors. The implications for standalone vendors are clear, and thus it is not surprising that vendors like Lanier, NBI, and CPT are adding computer functions to their standalone lines, usually through CP/M. But since most standalone word processors are sold into secretarial positions, computer power is often not needed.

Similar trends will be apparent on the terminal side of the house. Vendors such as DEC and Univac have introduced terminal upgrade packages that offer desktop features, and IBM communications will be standard for serious desktop competitors. HP has rolled its Terminal and General Systems Division into the Personal Computer Division.

The IBM PC will clearly affect 3270 sales in certain professional and managerial environments. The added cost of the computing power is not very significant. But as in the WP case, the scads of 3270s used strictly for data entry will find little reason to add computing power.

The third area of terminal convergence will be in the minicomputer/clustered WP systems. DEC, DG, Prime, and HP are all targeting the area dominated by Wang's 50% market share. Although Wang will continue to dominate the straight production typing market, that market will be the first to saturate, and the competition in the hybrid DP/WP system market is expected to be fierce.



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U.S. SHIPMENTS OF TERMINALS, DESKTOP COMPUTERS, WORD PROCESSORS
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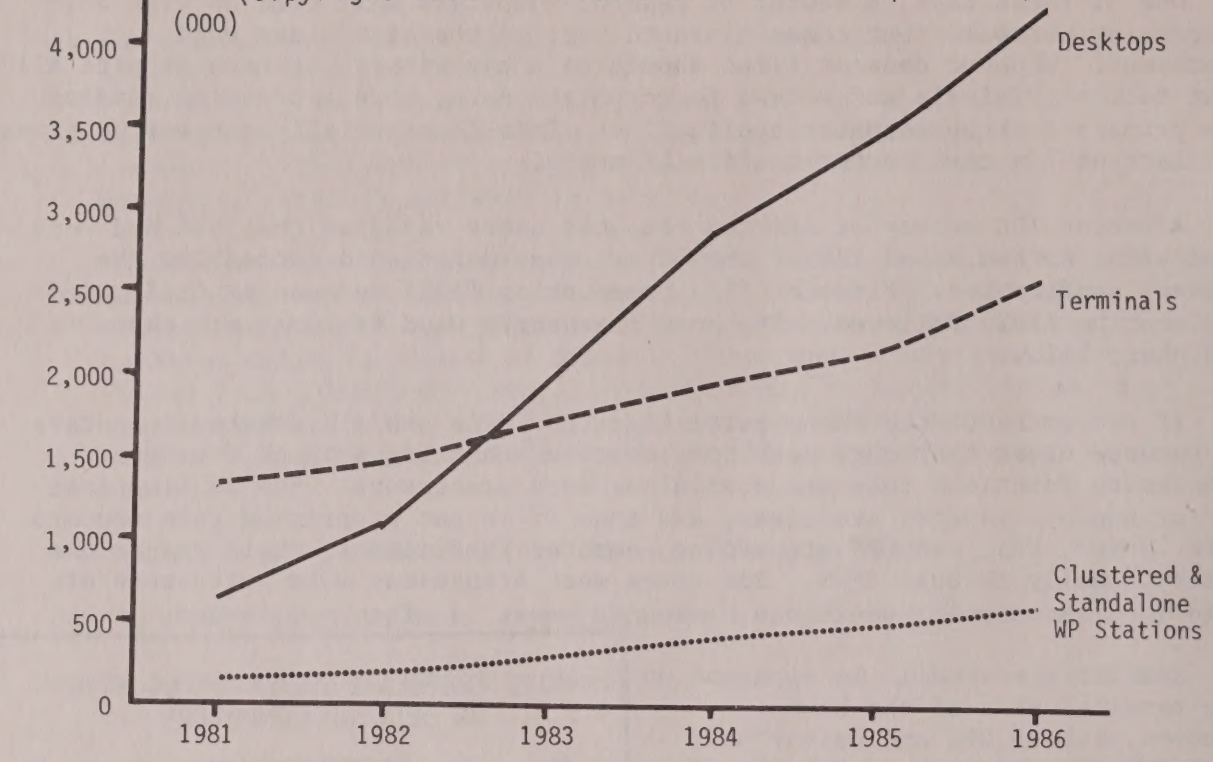

U.S. INSTALLED BASE OF TERMINALS, DESKTOP COMPUTERS, WORD PROCESSORS
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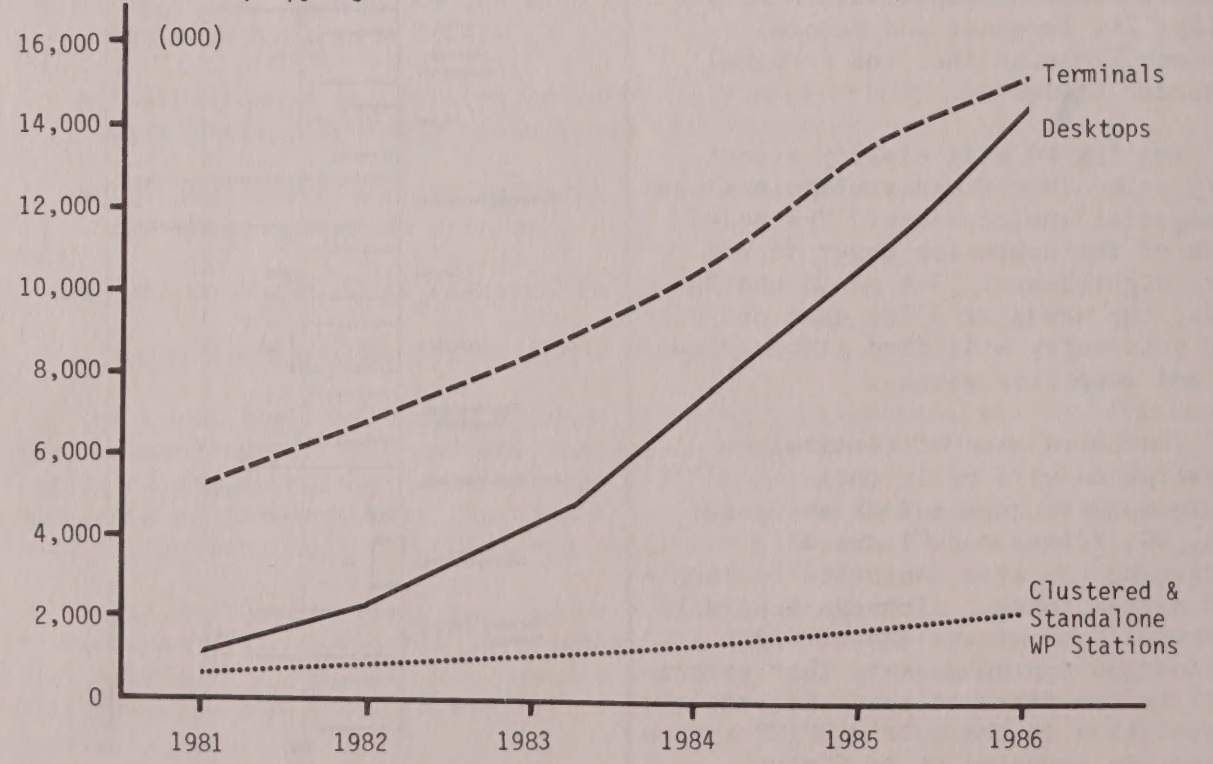

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U.S. LOOKS TO JAPAN FOR FAX SUPPORT

IBM is not the only vendor to look to the Japanese for facsimile help. The facsimile machine is perhaps the only information processing product that the Japanese have clearly taken over. The great majority of fax machines sold in the U.S. are made in Japan, even though they are often marketed under U.S. labels. This dominance has taken hold over the last five years and shows no signs of reversing itself.

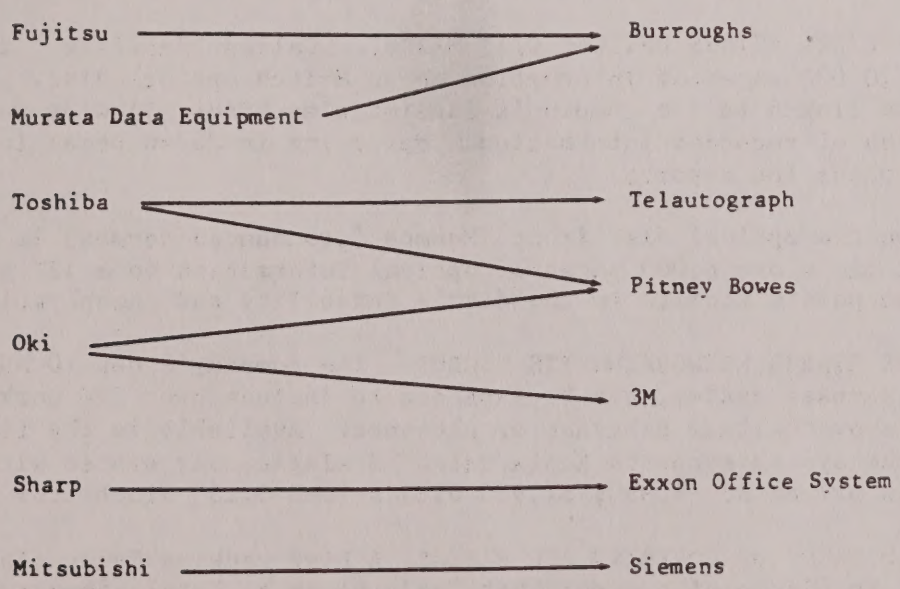
Perhaps the key reason for the Japanese success in this area is that facsimile machines are very important to Japan, whose 40,000 kanji character language does not easily lend itself to digital input/output. With their experience in cameras and copiers, the Japanese are strong in image technology.

International Data Corporation, publisher of EDP/IR, estimates that over the 1977-1981 period Japan tripled its production of facsimile devices to 129,000, while its exports grew 12-fold, reaching 37,000 devices in 1981. Over 29% of all Japanese facsimile production is exported with over half of that total going to the U.S. and Canada.

Unlike semiconductors and peripherals where the Japanese have tended to sell under their own name, Japanese facsimile vendors have aggressively pursued joint ventures with U.S. firms. This helps defuse any trade complaints and also enables them to address a facsimile market that demands nationwide service. The fax machines in many organizations are separated by great distances, and such organizations demand a nationwide distribution capability. A notable exception is Panafax (Matsushita) which is severing its relation with Visual Sciences and is marketing its machines on its own.

The market is quite different from that for copiers which can usually be handled through local dealerships. Below are the major Japanese/U.S. ties. In many cases, the Japanese have split their product line between U.S. outlets.

OEM RELATIONSHIPS OF FACSIMILE MANUFACTURERS, 6/82



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• MORE BAD NEWS. Intel has announced that in order to trim expenses by some $20 million it is cutting employee salaries by up to 10%, and will have some of its component plants shut down between Christmas and New Year's. Western Electric is laying off 800 workers and Lexidata is laying off 60. Datapoint has told its stockholders that at least two more bad quarters are on the way. As part of its scaleback operations, Xerox has merged its electronic typewriters, word processors, and personal computer into a single organization.

• QUIETWRITER GOES QUIETLY. Centronics has decided not to market its Quietwriter. Announced with much fanfare in 1979, the machine was to use a stylus-like device to print documents similar to the way a pen writes, with the idea being to minimize noise.

• CDC ENTERS 3375 MARKET. Targeting the 4300 DOS/VSE market, the CDC 33750 will also give CDC a lead-in to its 33800. Volume production of the 33800 will be in the second quarter of 1983 33750 production will begin in the fourth.

• HONEYWELL MERGES SEMICONDUCTOR GROUPS. In what could be the first step toward a more aggressive merchant semiconductor strategy, Honeywell has brought its Synertek, Solid State Electronics, Optoelectronics, and Visitronics operations into a single semiconductor group. Products from the Solid State group have always been captive to Honeywell needs, but some of its line will go commercial in 1983.

NCR is also showing a lot of interest in the merchant market. It recently dedicated a new 100,000 sq. foot microelectronics plant in Colorado Springs, CO. The site will produce NCR's new 32-bit microprocessor.

• SORBUS ENTERS IBM PC SERVICE MARKET. Claiming to be the first nationwide service group to offer full on-site and carry-in repairs, Sorbus is addressing what could be a major new market opportunity.

• MATSUSHITA ENTERS OPTICAL DISK MARKET. Called "Panafile," the machine can store 10,000 pages of information on an 8-inch optical disk. The system can also be linked to the company's facsimile machines allowing for the direct transmission of recorded information. Marketing in Japan began in October and there are plans for exports.

Also on the optical disk front, Mnemos (pronounced ne-mos) is offering disks that can store 6,000 pages of optical information on a 12" platter. The key selling points seem to be the disk's durability and cheap replication.

• ALTOS STARTS NETWORKING ITS MICROS. The company's new 10 MHz 8086-based 16-bit, five-user system, can be expanded to include over 200 workstations and peripherals over either Ethernet or Altosnet. Available in the first quarter of 1983, the system supports Xenix/Unix. A single user system with dual drive floppies is priced at $4,990; $7,990 with a 10MB 5.25" Winchester.

• COULD TANDY BE COVERING ALL BASES? A high-ranking Tandy official disclaimed knowledge of a rumor that Tandy plans an Intel 186-based desktop computer in 1983. He remarked it would be strange to use Intel considering the company recently announced the Motorola 68000-based Model 16.

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INDUSTRY TIGHTENS BELT TO COPE WITH RECESSION; LEAD BY IBM, NINE MONTH REVENUES AND EARNINGS UP 11%

As bad as this recession has been, it is not a reliable predictor of company fortunes. Market momentum, product cycles, company reputation, and management quality can often outweigh the economy's cyclical effects, and even in these worst of times, many are succeeding.

Though 1982 will not be a good year for the information industry, only the semiconductor industry shows the type of across-the-board downturn that smacks of raw economic forces. An EDP/IR survey of 33 major information processing companies shows that for the first nine months of 1982 revenues are up about 11% and earnings up about 9%, not too bad considering the drop in inflation.

Slackened demand has produced unprecedented layoffs and hiring freezes, and profit margins are being squeezed. In fact, if IBM is taken out of the above sample, industry earnings are actually down a little over 1981, even though revenues are still up 10%. But IBM's relative success suggests that there are some strong non-recessionary forces at work. A few points of note:

- Product cycles are important. IBM is having a strong year largely because it is shipping big quantities of 3081s and 3380s. Other mainframers have had troubles partly because they have yet to begin shipments of new high-end equipment and have been slow to develop low-end markets. DEC's recent slowdown is also partly attributable to its product cycles.

- Even without the recession, the mini industry would be in turmoil as it struggles to cope with the microprocessor forces that will shape the small systems market for the rest of the decade.

- Wall Street remains optimistic. Computer stocks have generally kept pace with the great bull market of 1982, and there is a general sense that many of the staff cutbacks were overdue and will help improve productivity and profitability.

- Most of the layoffs have come from the chip makers and the non-IBM mainframers. Much of the rest of the industry is relying on attrition and hiring freezes.

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HOW THE INDUSTRY IS REACTING TO THE RECESSION

IBM -- Mentions strong sales of 3081s and 3380s, despite increasing rate of order cancellations. IBM continues to be affected by currency exchange rates, claiming the change from 1981 to 1982 cost it $250 million in its nine-month earnings. Third quarter sales were up 35%, rentals up 5%.

NCR -- Cites increasing software and services revenues and improved cost control efforts. Domestic orders flat, international up a little.

Honeywell -- Domestic computer orders down substantially, international also down. Order deferrals also a problem.

Univac -- Computer revenues up 3%, backlog up 1%; does not expect significant recovery until well into 1983.

CDC -- OEM peripheral business suffering; service business doing better. Does not see dramatic pick up in peripheral sales.

Burroughs -- Revenues growing much faster than earnings. Profitability margins are thin.

Data General -- In its fourth quarter, operating profit was a mere $130,000, but revenues from Nippon Data General and interest on previous earnings made things look a little better. Orders are flat at best. DG continues to reorganize, change its executive lineup, and question its distribution strategy.

DEC -- Reported its first profit drop in seven years and has implemented hiring and wage freezes. Product cycles are not helping as demand for the PDP line diminishes while sales of the new Vax 730 and personal computers are just beginning. DEC expects one more slow quarter before things pick up again.

Computervision -- Orders are slowing, earnings are falling, and backlog is down. The company is also being faced with stronger competition both from established computer vendors and new start ups.

Chip makers -- The Semiconductor Industry Association says that chip makers are operating at only 75% of capacity. National Semi CEO Charles Sporck says that overall semiconductor industry sales will increase a dismal 1.4% this year; Motorola also expect its 1982 orders to be flat. The SIA reports that although imports of Japanese products increased nearly three-fold over 1981 (to $346 million in the first nine months), Japan still has only about 7% of the U.S. market and thus is not responsible for the domestic industry's hard times. The SIA remains bullish on 1983 and 1984, predicting 18% and 21% growth respectively. Since computer companies are by far the largest users of chips, full recovery will not arrive until computer shipments pick up.

Software and services -- Software industry revenue growth rates have stayed high (33%), and it would be mere conjecture to say what they would be in better times. Processing services firms have felt more of a pinch, especially in the remote problem-solving area which is often seen as a luxury. Some users have also brought in-house work which was once farmed out to processing services firms. But even without the recession, processing services vendors will continue to feel the pressure of low cost minis and micros. Xerox and Geisco are already offering micros as part of their service package.

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LIST OF KNOWN LAYOFFS

National Semiconductor --	1,000	Motorola --	270
Univac --	3,900	Storage Technology --	400
Control Data --	350	Datapoint --	250
Honeywell Information Systems --	3,000	Nixdorf --	250
Fairchild --	800	Motorola --	270
Texas Instruments --	12,500	STSC (Scientific Timesharing) --	55
Xerox --	5,630	Insurance Systems of America --	50

This does not purport to be a complete list of this year's layoffs, but it should cover just about all of the major company activity. In addition to the layoffs, there have been shutdowns, early retirement packages, hiring and wage freezes, and attrition too numerous to mention. In order to improve profits, even Tandem has forced all employees to take an unpaid 2.5 day "vacation."

REVENUES PER DOLLAR OF EARNINGS, SELECTED MANUFACTURERS 1977-1982

	1982	1981	1980	1979	1978	1977
IBM	$8.6	$8.8	$7.4	$7.6	$6.8	$6.7
Burroughs	30.9	13.0	19.6	5.3	9.7	9.9
NCR	17.5	16.5	13.0	12.8	13.5	19.2
CDC	23.5	26.0	30.3	34.6	50.8	76.1
DEC	6.7	6.9	7.1	7.8	7.9	7.8
DG	32.2	14.7	12.1	10.1	9.4	9.1
Prime	9.6	9.8	8.6	8.9	11.1	12.8
Wang	10.8	10.9	10.4	11.4	13.2	14.7
Apple	9.5	8.5	10.6	9.4	9.9	18.4
Tymshare	21.0	19.2	13.0	13.8	14.9	12.6
ADP	11.5	11.3	11.4	11.1	11.0	10.6

Notes: This chart can be used to look at relative profitability both over the years and between vendors. The data in the 1982 column is from the period specified in the chart on page 4. CDC figures are for its computer business only. All other numbers are taken from annual report revenue and earnings statements.

1981 AND 1982 FINANCIAL AND STOCK PERFORMANCE BY PRODUCT TYPE

	1982 Revenue $M	1981 Revenue $M	%Δ	Avg. P/E Ratio 10/82	Avg. P/E Ratio 1/82	Avg. Stock Price Jan 1-Oct 29	Avg. Earn. Change 81/82
IBM	23,290	20,777	12	13	10	43 %	22
Bunch*	14,244	13,432	6	9	7	23	-7
Minis	8,449	6,985	21	19	15	9	19
Services & Software	2,014	1,734	16	25	17	55	18
Semiconductors	7,773	7,492	4	17	15	44	-21
Total	55,770	50,420	11	16	12	34	7

** Bunch stands for Burroughs, Univac, NCR, CDC, and Honeywell. Revenues are for same periods specified on chart on page 4. The vendors in each category are the same ones listed in the chart on page 4.

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REVENUE AND EARNINGS COMPARISONS, 1981 AND 1982,
SELECTED MANUFACTURERS
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	Revenues 1982 $M	Revenues 1981 $M	% Δ	Earnings 1982 $M	Earnings 1981 $M	% Δ	Period
IBM	23,290	20,777	12	2,712	2,227	22	9 mo ending 9/30
Amdahl	316	319	-1	4	21	-81	9 mo ending 9/30
Burroughs	3,065	2,387	28	99	86	15	9 mo ending 9/30
CDC	2,396	2,250	6	102	149	-32	9 mo ending 9/30
NCR	2,463	2,387	3	140	118	19	9 mo ending 9/30
Honeywell	3,918	3,800	3	183	148	24	9 mo ending 9/30
Sperry	2,402	2,608	-8	25	88	-72	6 mo ending 9/30
DEC	3,880	3198	21	417	343	22	yr ending 7/82
DG	805	736	9	25	51	-51	yr ending 9/25
Prime	317	265	19	33	27	22	9 mo ending 10/82
HP	3,112	2,578	21	272	212	28	9 mo ending 7/82
Tandem	335	208	61	37	26	42	yr ending 9/30
Wang	942	700	35	107	78	37	yr ending 6/82
Xerox	6,244	6,275	-1	314	472	-33	9 mo ending 9/30
Datapoint	508	449	13	2.4	49	-95	yr ending 7/82
Rolm	380	294	29	30	24	25	yr ending 7/82
Tymshare	232	220	5	11	16	-31	9 mo ending 9/82
ADP	669	558	20	58	49	18	yr ending 6/82
EDS	509	454	12	47	38	24	yr ending 6/82
Comp. Sci.	331	298	11	9.3	6.9	35	6 mo ending 10/82
NDC	120	96	25	11.2	8.1	38	yr ending 5/82
Cullinane	56	33	70	8.4	5.4	55	yr ending 7/82
MSA	60	43	39	2.2	2.4	-8	9 mo ending 9/82
Pansophic	37	32	16	4.9	2.9	69	yr ending 7/82
Apple	583	334	74	61	39	56	yr ending 9/30/82
Tandy	2,032	1,691	20	224	169	33	yr ending 6/30/82
Commodore	304	186	63	41	25	64	yr ending 6/30
Storage Tech	798	643	24	56	50	12	9 mo ending 9/82
Hazeltine	75	71	6	2.5	1.7	47	6 mo ending 6/82
Intel	660	589	12	22	23	-5	9 mo ending 9/82
Motorola	2,790	2,636	6	114	138	-17	9 mo ending 9/82
Nat'l Semi	1,104	1,110	-1	-11	52	--	yr ending 5/82
Texas Instr	3,219	3,157	2	101	71	42	9 mo ending 9/82

Notes: Honeywell, Sperry, Tandy, and Hewlett-Packard data includes revenues and earnings from non-computer operations.

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COMPARISON OF STOCK PRICES AND PRICE/EARNINGS RATIOS
1981 AND 1982, SELECTED MANUFACTURERS,
(Copyright 1982 -- International Data Corporation)

	Stock Price Jan 1/82	Stock Price Oct 29	%Δ	PE Ratio Jan 1	PE Ratio 10/29	1981 High	1981 Low
IBM	56	80	43	10	13	71	48
Amdahl	29	20	-31	22	55	44	17
Burroughs	45	44	-2	10	12	79	27
CDC	34	36	6	8	9	-	-
NCR	43	82	90	5	10	77	39
Honeywell	69	91	32	5	8	114	69
Univac	35	27	-23	7	7	65	29
DEC	86	89	3	12	13	112	61
DG	53	38	-28	14	21	67	40
Prime	23	31	35	19	22	47	17
HP	39	62	59	15	21	50	38
Tandem	28	30	7	-	-	-	-
Wang	29	48	66	22	26	41	22
Xerox	40	38	-5	5	7	65	37
Datapoint	51	19	-63	21	163	53	50
Rolm	32	43	34	22	24	50	25
Apple	22	25	14	-	-	-	-
Tandy	33	41	24	19	18	39	26
Tymshare	19	20	5	11	23	-	-
ADP	24	33	37	15	19	-	-
EDS	21	46	119	14	25	-	-
Comp. Sciences	13	17	30	11	17	-	-
NDC	18	17	-5	20	17*	-	-
Cullinane	30	51	70	31	43	-	-
MSA	21	39	85	25	32*	-	-
Pansophic	10	20	100	16	20*	-	-
Intel	23	39	70	-	-	-	-
National Semi	19	23	21	19	-	41	17
Motorola	57	82	44	10	17	86	48
Texas Instr.	80	114	43	15	20	126	75
STC	35	10	-71	16	8	40	13
Hazeltine	26	36	38	13	25	28	18
Lear Siegler	29	32	10	6	8	42	19

Notes: Services and software stock prices as of 2/8/82 and Nov. 8.
* P/E as of 9/20. Some high and low price stock figures were unavailable.

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Conclusion

Although it would be silly to imply that a $75 billion industry could be exempt from macro forces, the success or failure of any one firm can often be explained by non-economic events. Even if there was no recession, EDP/IR doubts whether Univac, NCR, Data General or Tymshare -- to name just a few -- would have had good years. On the other hand, the recession apparently has had little impact on the sales of Wang, Apple, or Tandem.

Last year, the information industry grew some 20% in an inflationary environment of 10%, or a real gain of 10%. For 1982, the real gain will be more like 6% -- 11% growth minus 5% inflation. Thus, in the roughest terms, the recession could be said to have knocked about 4% off the industry's performance. This assumes that, economic forces being equal, the industry would have grown as fast in 1982 as it did in 1981.

If IBM is taken out of the picture, the product cycles of the rest of the industry would have suggested a slight downturn. Although both start ups and established vendors are developing a new generation of microprocessor-based products, it will take a while to translate this activity into meaningful industry growth. OEMs in particular are faced with a wide variety of product options using 16/32 chips and 5.25" winchesters. Consequently, EDP/IR feels that the 4% recessionary impact figure might be just a little high from a revenue perspective. The market is in transition, and when the patterns are finally settled, growth will resume, with some new winners and losers.

CHINESE COMPUTER INDUSTRY 15 YEARS BEHIND WESTERN NATIONS, BUT IMPROVEMENTS GIVEN HIGH INDUSTRIAL PRIORITY

> *"Our consistent policy is to rely on ourselves, and at the same time learn from the advanced technology of foreign countries."* -- Li Rui, general manager of the Bureau of the National Computer Industry

Yes, the Chinese do develop and produce mainframe computers, minicomputers, microprocessors, LSI chips and relational data base management systems, and yes they are, by their own admission, 15 years behind advanced western nations. But as the sleeping giant moves to modernize, the key question is: what is China's attitude toward foreign vendors, and will this nation of one billion people fall further behind, or will it begin to catch up?

The question of China's response to the west is older than this century, yet it continues unresolved. As far as computers are concerned, China has made it clear that it intends to give its domestic computer industry a high priority, but at the same time it realizes that it must take better advantage of what the West and Japan have to offer, a difficult juggling act.

Not that the West is ready to fully open up the export doors. Exporting computer technology to communist nations is still a sensitive and complicated affair. Applications take at least two months for approval and some requests are denied. The Commerce and State Departments use different methods of approval for systems of different power. Memory and throughput specifications determine approval practices. High-end systems must also get the approval of COCOM, (the COnsultative COMmittee representing 14 nations, mostly NATO and Japan). A spokesman for the Commerce Department said that Chinese interest has indeed picked up considerably in recent months.

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BASIC FACTS OF THE CHINESE COMPUTER INDUSTRY

Workforce: There are about 1 million electronics workers in China working in some 3,000 factories. It is estimated that 100,000 of these are involved in the research, design, manufacturing, and use of computers. Half of this total work in 80 factories under the Ministry of Electronics. There are also 40 computer technology research institutes and 60 universities with computer science departments.

Production capability: In the first nine months of 1982, China produced 160 general-purpose computers and 500 microcomputers, an increase of 62% and 160% respectively over the same period in 1981. Mr. Li says that China hopes to be able to produce 1,000 general-purpose and 10,000 micros every year by 1985, with the figures rising to 1,800 and 40,000 by 1990. Right now some 3,500 general-purpose and 10,000 micros are being used in China. (The "general-purpose" category includes minicomputers.) Additionally, some 25 service bureaus are in operation, with many more planned.

As an indicator of general electronics capability, in 1981 the Chinese turned out 36 million radios, 5 million TVs, 2.6 million calculators, and 1.3 million tape recorders, all substantially greater than the 1981 totals. China also manufactures its own broadcast, ground satellite and other telecommunications equipment. As for consumer goods, China hopes that all families will have a radio by 1985, and one-third will have televisions by 1990.

Imports: Over the last 30 years, China has imported some 500 general-purpose computers and 10,000 micros. Over the last two years China has signed contracts with 210 foreign firms, and is said to be very interested in establishing joint ventures with foreign firms. Sperry Univac and Nippon Electric are involved in service bureau projects, while Honeywell has recently signed an agreement to help develop large and medium scale machines. HP recently gave a series of seminars in China concerning programmable calculator technology.

As for hardware sales, DEC sold 15 PDP-11s in the first eight months of 1982, and Wang has an order for 15 of its 2200s. As of October 1979, the U.S. had shipped a total of 111 general-purpose and minicomputers to China. Japan had shipped 89, France 29, West Germany 26, and the USSR 18. Sharp is presently negotiating with COCOM for approval of the sale of large numbers of microcomputers to China. NEC also hopes to sell several hundred micros.

BRIEF HISTORY OF THE CHINESE COMPUTER INDUSTRY

1958 -- First vacuum tube computer
1964 -- First transistor computer
1971 -- First small scale integration computer, the 109B and others
1974 -- LSI-based family of minicomputers, the DJS-130
1975 -- First microprocessor prototype, PMOS
1977 -- DJS-060 microprocessor-based computers
1981 -- First commercial data base management system
1982 -- First multifunction graphics generator

The above information came to EDP/IR via EDP China Report, IDC's latest newsletter.

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• HP BRINGS OUT INDUSTRY'S FIRST 32-BIT DESKTOP. HP's much heralded 32-bit N-MOS technology is the heart of the new 9000 series aimed at the scientific/ engineering market. With the 1 MIP power of a supermini, the machine will compete with DEC and Prime, but more closely resembles the approach of Apollo. HP is calling the system "the personal mainframe," and says it is the result its largest R&D effort to date. The system runs under Unix or HP's Basic and supports Ethernet and HP networking schemes. The new machine will be available in January with networked systems scheduled for the second quarter. Prices range from $28,000 to $65,000. NCR is also expected to announce a system based on its 32-bit microprocessor in the near future.

• IBM FORGES NEW OFFICE LINKS. IBM continues the tortuous process of hammering links between its diverse office gear. The new announcements include: a store-and-forward facsimile device that doubles as a copier; ties between the 5520 and the Displaywriter to DISOSS; the formal offering of PROFS, previously only sold as an RPQ; and communications between the personal computer and the 5520. Apparently, IBM is committed to making the best out of this basically incompatible gear, no doubt at a high cost to itself.

• IBIS ENTERS 3380 ARENA. Using ferrite read/write heads and its thin film media, the start-up's 5380 matches the IBM 3380's 2.5 gigabytes per four actuator drive. As with the 3380s, an optional speed-matching buffer options allow channel speeds of 3MB, 2MB and 1.5MB per second. Four models are available at prices ranging from $78,000 to $111,000, competitive with the rates announced by STC. The one-director controller goes for $75,000 and the two-director version lists for $136,000 in single quantities. Initial shipments are scheduled for the second quarter 1983 with volume shipments in the third quarter. Shipments of a custom OEM version will begin this year.

• DG ENTERS LOW-END SUPERMINI RACE. Aimed squarely at the Vax 11/730, the new MV/4000 is said to have the best performance of any machine in its class. Rated at 0.6 MIPS or 50% of the power of the MV/6000, the machine can support up to 8MB memory ($9,000/MB) and up to 64 terminals. A sample configuration with 1MB memory, a 147MB winchester, 1600bpi streaming tape, system console and AOS/VS operating system goes for $63,400. In its press presentation, DG said it is specifically targeting both the industrial automation and office automation markets. The new machine is available 30 days after receipt of order. With the /4000, DG introduced a laser printer, a low-cost letter-quality printer, a 15MB cartridge tape drive and a 50MB winchester.

• FUJITSU HITS U.S. DESKTOP MARKET, AGAIN. The second wave of Japanese desktops is arriving. After having little luck with its Affinity 16 machine, Fujitsu is coming back with the Micro 16S, which uses an 8088 and a Z80 under CP/M, with memory from 128K to 1MB. Fujitsu claims theirs is the first machine to have 128K of error-detecting memory; it also claims superior graphics thanks to a 52KB support RAM. A Micro 16S with 128K, CP/M 86, word processing and spread sheet software, and black and white monitor goes for under $4,000. A 10MB winchester is available for $2,000. Fujitsu says the machine will be available at retail outlets in February.

• STRATUS MOVES TO $5,000/MB MAIN MEMORY. The announcement came as part of the introduction of the model 127, which offers removable drives.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

MOLLY UPTON, EDITOR NOVEMBER 8, 1982 ● VOL.18,NO.14 P.J. MCGOVERN, PUBLISHER

IBM slashes 4300 prices; PCMs respond

IBM, HP, OTHERS BRING OUT FAULT-TOLERANT MACHINES; MARKET MOVES BEYOND TRANSACTION PROCESSING

Tandem's glamorous five-year run from almost nothing in 1977 to $208 million in 1981 stands as clear evidence of the demand for fault-tolerant or redundant computers. But despite that company's heady success it has taken the competition a while to respond; only now is the rest of the industry catching on.

Start-ups such as Stratus and Synapse have recently been joined by heavyweights IBM and Hewlett-Packard, as well as the quietly successful Computer Consoles. Since redundancy comes in many forms and degrees, the new players will significantly increase user flexibility and drive down the premiums traditionally associated with back-up machines.

IBM seems anxious to enter the market. When its 3084s were announced in September, the giant included redundant system support hardware and came just short of claiming full system resiliency. Now by offering a redundant Series/1 option, it is moving in at the low end. Unfortunately for the giant, most of the action in the fault tolerant market thus far has been at the 32-bit supermini end, and IBM does not really have a machine in that class.

Since the market is very young, clear technological and market patterns have yet to be established. Vendor strategies contain some significant differences. Among the issues:

- Applications. Tandem, Stratus, Synapse, and Computer Consoles Inc. (CCI) are targeting the transaction processing market. HP, with its 1000 Series, is aiming at the process and instrument control market. IBM is not specifying any particular application. CC also believes that there is a market within office automation

- Technology. Stratus, Synapse, and CCI are relying on the Motorola 68000. Tandem, HP, and IBM are using in-house CPU technology.

- Distribution. Tandem, Stratus, and CCI are primarily selling direct. HP and Synapse are leaning towards OEMs. IBM will go both routes, expressing no preference for either.

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Many paths to redundancy

Technological debate seems an inevitable part of any new market. Although not as shrill as last year's broadband vs. baseband wrangle, Stratus and Tandem in particular have waged an aggressive media battle that almost wound up in court. Synapse is touting an architecture vastly different than either; while newcomers IBM, HP, and CCI use their own variants of the three.

The basic hardware question is whether to have the back-up facility do any real work in normal operations. Tandem's approach is based on what it calls "parallel processing." In a simple two processor configuration, each processor does its own work and in the event of CPU failure the live system takes over full responsibility. To maintain response times each system should operate at 50% capacity. In normal operations the two processors constantly check back and forth to make sure the other is still alive and well. In peak transaction periods, this cross-checking can work to the detriment of system performance.

Stratus, on the other hand, uses totally redundant hardware. Each of its two processors (built inside a single box) works on the same job. If one CPU fails, the other keeps going, and thus no throughput deterioration should occur. Synapse uses multiple Motorola 68000s within a single box, always configuring one more processor than is necessary do the job, hence the product name, N+1. The company mirrors disks at the logical level, meaning the user can segment a disk into redundant and non-redundant areas.

IBM offers a little bit of each. It can hook anywhere from 2 to 16 Series/1s together under a single copy of the operating system with dynamic peripheral connections. Each Series/1 can be dedicated to performing unique work, being a back-up, or as a multiprocessor system. Accordingly, each CPU can have its own or share other's peripherals. The multiprocessing operating system transparently manages device sharing. In non-redundant use, IBM is pushing multiprocessing Series/1s from a performance point of view.

In January 1981, IBM announced a communications monitor that allowed up to 16 Series/1s to be connected, but that was a peer-to-peer system, whereas the new system allows the whole network to operate as a single image. Both systems use the same local communications controller ($3,300) and ring architecture.

HP goes for the traditional hot standby/mirrored disk approach. The Systemsafe/1000 consists of either two HP 1000 Model 60s or /65s (approximately 1 MIP). Both systems read all serial input data, but only the primary system is allowed to produce data or control commands. If a failure is detected in the primary system, full control is shifted to the back-up system. HP says that it is the first vendor to focus on non-financial applications, mentioning process control, machine monitoring, data acquisition, communications control, and facilities management.

Computer Consoles (revenues $50 million in 1981) has been building fault-tolerant computers since 1973, but its systems have been used almost exclusively in the telephone industry, primarily for directory assistance. Now CCI is taking its technology public, targeting the transaction processing and office automation markets. Like Synapse, its approach is to use a highly dynamic configuration that allows for the mix of redundant and non-redundant data and CPUs, with the idea being to minimize redundancy overhead. CCI's Perpos operating system is based on Unix.

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FEATURE COMPARISON, REDUNDANT SYSTEMS
(Copyright 1982 - International Data Corporation)

	Tandem Non-Stop II	Stratus/32	Synapse N+1	Computer Consoles PP5/55	IBM Series/1	Hewlett-Packard 1000
Architecture	16/32	16/32	16/32	16/32	16	16
CPU	Custom	68000	68000	68000	Custom	Custom
Maximum Memory per CPU	8MB	8MB	16MB	4MB	512KB	2MB
CPU-CPU Link	Guardian/expand	Stratalink	None	Data Highway	Ring Network	Clock synch.
Maximum Disk Size Supported	240MB	287MB	413MB	600MB	64MB	120MB
Redundancy Approach	Software Check Pointing	Hardware Redundant	N+1 Processors	Logical Redundancy	Either Hot Standby or Multiprocessor	Hot Standby
X.25	Yes	Yes	No	No	No	No
Primary Sales Method	Direct	Direct/OEM	OEM	Direct	Direct/OEM	OEM
Applications	Transaction Processing	Transaction Processing	Transaction Processing	Transaction Processing/Office Automation	Not Specified	Industrial Controls
Mirrored Disk Technique	Physical	Physical	Logical	Logical	Physical	Physical
Cost of typical configuration	$155,000-$175,000 -- dual CPU (512KB), tape drive and controller; console; control processor; 2 battery packs; operating system	$125,000 -- 2 disks 2MB memory; redundant controllers; operating system; Cobol; terminal	$340,000 -- 7 processors (2 general, 3 I/O, 2 commo.) 6MB memory, 2 disks, 2 controllers, tape drive, 2 consoles	$162,000 -- 2 CPUs, 2 controllers; 2 tape drives; 2 150MB disks; 1 terminal; operating system	$80,690 -- 2 512K CPUs; 2 64MB disks; 1 terminal; 2 controllers; RPS version 6 operating system	$199,000 -- 2 HP 1000/60s with 2MB memory; two 19.6MB disks; console; RTE-6VM Fortran 77; HP Pascal
Available	1Q/81	1Q/82	4Q/82	2Q/83	2Q/83	2Q/83

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Looking at what Tandem has done and given the spate of vendor interest, there seems to be a rosy future for redundant systems. Both AT&T and IBM have made public comments that they believe that "highly resilient" machines will become the norm in the not too distant future, and there is little doubt that as on-line systems take on increasing importance, system downtime will become less tolerable. Redundant applications will expand outside the transaction processing business to include everything from factory automation to medical monitoring systems.

NCR, which considers itself a leader in on-line transaction processing, recently told EDP/IR that its next generation of products will be patterned somewhat after Tandem's. Multiple processors will run in parallel along a single data bus with lots of resource sharing and back-up capabilities. The company considers this type of flexible architecture to be more important to its processor future than merely building bigger and faster machines. (EDP/IR expects that the machines will be announced within the next 12 months).

Given the falling cost of hardware, and the declining share of the CPU in terms of average system values, the premium paid for processor redundancy will continue to drop. What won't drop is the cost of mirrored disks, controllers, and other peripheral subsystems. The disk cost alone will prevent many applications from being fully redundant. What will evolve will be a portfolio of redundancy options from which the user can make his own economic decisions. Logical redundancy from both a disk and CPU perspective will further improve the cost justification process.

But even with these new hardware systems, fault-tolerant machines will still be limited by the software and operator errors which are responsible for the majority of system failures. The solution to this problem, if there is one, will be much more difficult than merely building low cost duplicate boxes.

IBM SLASHES PRICES; MEMORY COSTS PLUNGE; NEW 4300s FILL OUT ALREADY CROWDED LINE

In a wide ranging series of announcements, IBM has substantially cut prices for almost all of its small processor systems. The lowering of the IBM umbrella reflects events in the rest of the industry. In fact, in an unusual statement IBM noted that its price cuts will "enable IBM to compete more effectively in the growing small systems marketplace." Normally, IBM cloaks its price changes with talk of "normal business review." Given that IBM's revenue/earnings picture looks good, the moves do seem competitively motivated.

Memory price cuts led the way. In a rare burst of consistency, IBM appears to be standardizing the cost of main memory on its small systems. A megabyte of memory from IBM costs $10,000 on the 4300 (down from $15,000), the Series/1, and the System/38. The 308X line still clings to the $25,000 slope of the last few years. The memory price cuts were only part of the attack on the PCM CPU and disk manufacturers. In general, the PCMs have responded effectively, but are now faced with the task of trying to gauge IBM's current 4300 strategy. Among the key IBM actions:

- New 4300s. The 4341 family has expanded at the high and low ends. The new 4341-9 has 70% of the performance of the 4341-10, and the 4341-12 is 15% more powerful than the 4341-2. IBM now has ten processors in the 4300 family which only spans about 1.5 MIPS.

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- 4300 price cuts. The 4331s were cut the most with an average of 27%. The 4341s were cut by an average of 14%. The cuts have changed some of the family's price/performance relations (see chart), and brought the 4300s into line with supermini prices.

- Disk price cuts. Steep cuts on the older 3310 and 3340 drives. Surprisingly, even relatively new disks such as the 3370 and 3375 saw prices cut by an average of some 25%.

- New software availability. IBM is now offering the SSX operating system (originally only available on the 4321/4331) on the 4341 family. It is also allowing SSX users to use SQL, its relational data language previously available only under DOS/VS.

- A new 3884 controller. An entry-level ($35,000) version of the 3880, with a single storage director instead of the usual pair, is designed to attach 3370 and 3375s to 4300-class machines.

- Other processor price cuts. Purchase prices for the 8100 were cut by an average of some 10%. System/38 prices were cut from 10% to 25%, and Datamaster (System/23) prices were cut 12% to 24%.

Steep price cuts such as these suggest the possibility that a replacement series for the three-year old 4300s may be on the way. It looks like the 4331 series is in the most jeopardy. The new 4341-9 looks like a much better buy than either the 4333-1 or 4331-11, especially since it offers an upgrade path into the rest of the 4341 family. The only advantage the 4331 machines have is in communications environments since the 4331's integrated communications adapter saves the user the cost of a 3705 front-end processor.

The introduction of two new 4341 models suggests that the 4341s are not slated for rapid obsolescence, and the price cuts on the 4341s were significantly less severe. The aggressively priced 4341-9 continues IBM's effort to push 4300s as CAD/CAM machines, while offering the best price/performance in the entire 4300 family. The 4341-12, on the other hand, does not seem to offer much new. Rated at 15% faster than the 4341-2 in commercial environments and 7% faster in scientific applications, its price/performance is not significantly different from the 4341-2. It supports the same memory sizes, but it does offer slightly improved block multiplexer channel capacity.

EDP/IR's best estimate of IBM 4300 strategy is that the 4341-1 and 4341-2 will be de-emphasized, leaving a coherently numbered lineup of 4341-9, 10, 11, 12. The 4331 and 4321 will be effectively, but not drastically, obsoleted by a new microprocessor-based system, possibly called the 4311.

IBM is unlikely to totally devastate the residual values of its large 4331 base which IDC estimates consists more than 5,000 systems in the U.S. Some 50% of these systems are on IBM leases, and many are reaching their maximum accrual point. The giant does not want to have these machines returned so that users can buy cheaper hardware. IBM's situation is unusual in that the superminis the 4331s compete against are usually purchased outright.

Magnuson is setting its eyes on the 4331 leasing base. In an unusual move, the company is willing to apply purchase accruals on IBM machines toward purchase of a Magnuson CPU of equal or greater power. This is tantamount to a

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considerable (as high as 50%) discount. Magnuson said it will also absorb the cost of breaking existing 4300 leases, another discounting ploy.

EDP/IR believes that IBM needs a machine that fills the wide performance gap between the IBM 3083E (rated at 185) and the 4341-12 (rated at 74). The failure to announce the machine at this time seems to indicate that the gap will be filled either from the 308X side or by the replacement series, or quite possibly a combination of both.

STC Enters 4300 battle

The PCM suppliers are steadily moving toward the system business. Two months ago Amdahl announced its entry into the disk market. National Advanced Systems is expected to follow suit. Now, after much anticipation, Storage Technology has made its entry into the CPU business using Magnuson-built CPUs, targeting the middle of the 4300 line, and emphasizing packaged systems.

The one catch is that STC is not using its own name, dumping the tasks off onto its little-known Ultimacc Systems Group, in Waldwick, N.J. That decision hardly inspires confidence in the company's commitment, especially given the cancellation of STC's (VSS) project which was to use similar Magnuson machines. The new 4300 effort looks like a way to unload systems already contracted for.

STC will initially offer two systems: the USX39 (.55 MIPS) and the USX40 (.62) MIPS. The chief difference between the two systems is that the /40 has a 16KB cache and the /39 has no cache. The Systems are based on Magnuson's M80/3X series but are said to be built to STC specifications; they will primarily use STC's 3350-type disk. An STC spokesman added that STC expects the 4300 market to change significantly over the next few years, and it may select another CPU supplier at some point along the way. He viewed the tie with Magnuson as a way to get into the market quickly. STC's plans to acquire Magnuson fizzled last January.

The two machines are targeted at the new IBM 4341-9, and STC promises that its configured system prices will be 20% to 40% cheaper than comparable IBM prices. Because minimum configurations are required, direct price comparisons are difficult. STC says that a 2MB USX39 with 3 channels, 3350-type controller, its 4500 tape drive, and 1,200 lpm printer lists for $167,000, $5,688 per month on a three-year lease; disk and tape units are sold in packaged modules. The /40 with the same configuration goes for $205,000, $6,973 per month on a three-year lease. DOS, VM, and SSX are supported. The two machines are available now.

The systems will be sold direct by Ultimacc Systems, but the parent company will also push them. Ultimacc, acquired by STC in 1974, has specialized in selling turnkey systems built around Data General minis. A spokesman said that it will eventually sell turnkey systems built around IBM equipment. The company estimates 1982 revenues will be about $8,000,000 and it employs about 150 people. The group is not connected to STC's mainframe project group.

Although another 4300 PCM does not seem to be a pressing industry need, STC will have one advantage over its PCM rivals. It will be the only PCM in the 4300 range that can offer a full line of storage peripherals and it can take system configuration headaches away from the user. The move may also help STC sell more 3350-type disks while it struggles to get its 3380s to market.

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CURRENT IBM/PCM 4300 PRICES
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IBM	Memory (MB)	Price ($)	IDC Perf. Rating	Price/ Rating	% Latest Price Cut	Price/MB Memory
4321	1	$64,000	11	$5,818	25%	$10,000
4331	1	62,170	11	5,615	22	10,000
4331-11	2	92,420	18	5,134	34	10,000
4331-2	2	92,500	22	4,204	26	10,000
4341-9	2	91,000	25	3,370	--	10,000
4341-10	2	150,000	36	4,166	16	10,000
4341-1	2	205,000	40	5,125	9	10,000
4341-11	4	260,000	50	5,200	15	10,000
4341-2	8	390,000	66	5,909	14	10,000
4341-12	12	460,000	74	6,052	--	10,000
IPL						
4436	2	$135,000	27	$5,000	14%	$8,000
4443	2	180,000	45	4,000	2	8,000
4445	4	222,000	56	3,964	15	8,000
4446	8	330,000	70	4,714	14	8,000
4460	12	375,000	80	4,687	--	8,000
Magnuson						
M80/20	.5	$59,000	12	$4,916	--	$10,000
M80/30	2	77,500	16	4,843	28%	10,000
M80/31	2	93,500	26	3,596	28%	10,000
M80/32	2	115,000	32	3,593	28%	10,000
M80/42	2	173,000	45	3,844	5%	10,000
M80/43	8	191,000	54	3,537	5%	10,000
National Advanced Systems						
AS/3000N	2	215,000	40	$5,375	0	13,750
AS/3000	4	250,000	50	5,000	0	12,500
AS/5000E	4	400,000	60	6,666	0	25,000
AS/5000	4	500,000	62	8,064	0	25,000
AS/6130	4	348,000	66	5,272	0	13,750
AS/6150	4	420,000	86	4,883	0	13,750

Notes: The IBM 4321 contains certain features as standard that make it a better deal than 4331-1. The 4341-12 will be available in February 1983; the 4341-9 in March 1983. Magnuson prices are based on flat rate cuts given by company; specific price lists were not provided. Thus, Magnuson prices should be viewed as good estimates. Also Magnuson's new M80/20 was announced just prior to the IBM announcement, and the company may lower its price before shipments start. National Advanced Systems has yet to announce its price reaction. A spokesman said that cuts are expected, but they have not been announced as of 11/8/82. Shipments of the IPL 4460 will begin in March 1983.

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• NCR ENTERS OEM CPU BUSINESS. NCR is taking a packaging approach to low-end system building. A 10Mhz Motorola 68000, the Unix operating system and OEM winchester and streaming tape drives have been packaged into a mid-sized mini that is aggressively priced. Nicknamed the Tower because it is 29" tall and only about 6" wide, the product is aimed at the two- to 16-user 16-bit mini base of systems, with minimum configurations priced as low as $12,000. The system will also soon be offered to NCR's end-user base.

NCR believes that it will be the first vendor to incorporate the 10Mhz 68000 which it compares to the PDP 11/70 in power. It believes that many OEMs are ready to move away from today's minicomputer architectures which are often limited to a 64KB address space. The $12,000 figure includes: CPU 256K memory, 10MB winchester, 1MB floppy disk and necessary ports, controllers, and interfaces. Up to 2MB memory is available and up to an 80MB winchester ($8,000) can be attached. Shipments will begin in April. Since Unix is not widely used outside the U.S., there are no plans for international marketing. Up to this point, NCR's OEM efforts have been limited to some terminals, printers, and MICR devices. The Tower, officially the NCR 1632, represents a change in course in that NCR is making an effort to support as many peripheral interfaces as possible. NCR president Charles Exley also took the occasion to reconfirm a previous statement that NCR's entire processor product line will be overhauled within the next 24 months. Its version of a personal computer, "the decisionmate," will be announced shortly.

• HP BRINGS OUT NEW MINI, DESKTOP. HP is claiming that its A900 sets dramatic new price/performance levels for the minicomputer industry. Using single-precision whetstone measurements, the A900 can handle 1.2 MIPs and is priced at $24,000, $15,000 in quantities of 100. In scientific applications, HP says the machine can go as fast as 3 MIPS. Up to 6MB of main memory is available at a price of $5,333/MB. HP also announced that it will incorporate 3.5" micro-floppies into much of its desktop computer line. The Sony-built drives range from 270KB to 540KB; a 4.6MB winchester is also available for $4,975. In another move, HP has confirmed its faith in the future of desktops by consolidating its terminal and desktop computer groups into a single division.

• HONEYWELL LAYS OFF 1,850 MORE. New Information Systems president James Renier has made his first major move. Once again, the majority of the cuts (800) will come from the company's small systems groups in Massachusetts. 450 will be cut from the large systems group in Phoenix, 115 from the Minneapolis headquarters, and another 450 overseas. The move brings this year's layoffs to some 3,000, out of a worldwide workforce of 27,000.

• SBS TO ENTER RESIDENTIAL PHONE SERVICE. Beginning in December, Satellite Business Systems will offer long-distance phone services to residences and small businesses at rates 14% to 30% less than those of the Bell system. The move is an admission of the excess capacity within the SBS network.

• UNIVAC TO CHANGE NAME. In order to increase its corporate visibility, beginning in April, Sperry's three high-technology businesses will market their products under the Sperry name. The new names will be Sperry Flight Systems, Sperry Electronic Systems, and Sperry Computer Systems. Thus, the venerable Univac label will be discontinued.

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NOV 9 1982

"The Gray Sheet"

EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

MOLLY UPTON, EDITOR OCTOBER 24, 1982 ● VOL.18,NO.13 P.J. MCGOVERN, PUBLISHER

HONEYWELL ANSWERS HIGH-END CHALLENGE; NEW MAINFRAMES RIVAL IBM 308X, UNIVAC 1100/90

Ninety-two days after Univac, 170 days after CDC, and a full 324 days after IBM, Honeywell Information Systems announced a new generation of mainframes, publicly known as the DPS 88.

Internally referred to as Orion, the series maps right onto the price/performance standards set by its competitors. And although the system may not be the mighty hunter implied by its mythological namesake, it should prove to be an able defender of Honeywell's considerable mainframe installed base.

Two systems have been announced: the DPS 88/81 (7 MIPS) which is competitive with the IBM 3081J, and the dual processor DPS 88/82 (13 MIPS) which is in the range of the IBM 3081K. Three and four processor versions have been promised, raising the total system potential to 24 MIPS.

In addition to being roughly four times as powerful as the DPS 8/70 they will replace, the Orion machines are significant in that they further confirm many of the key mainframe trends of the day. Among them:

- New packaging. Although not quite as dense, Honeywell's new Micropackaging is in concept very similar to the Thermal Conduction Modules employed in IBM's 308X's.

- Multiprocessing. As is the case with Univac, Honeywell's years of multiprocessing experience are starting to come in very handy.

- Liquid cooling. As with IBM and Univac, the circuitry in the DPS 88 is water cooled. Honeywell says liquid cooling looks like an essential part of its future large systems.

- High speed circuitry. Honeywell's Current Mode Logic (CML) technology is a variant of the ECL used by Univac and the PCMs. IBM is still using the older and slower TTL devices.

- Modularity. Like its competitors, Honeywell hopes to increase CPU throughput by building sophisticated I/O subsystems.

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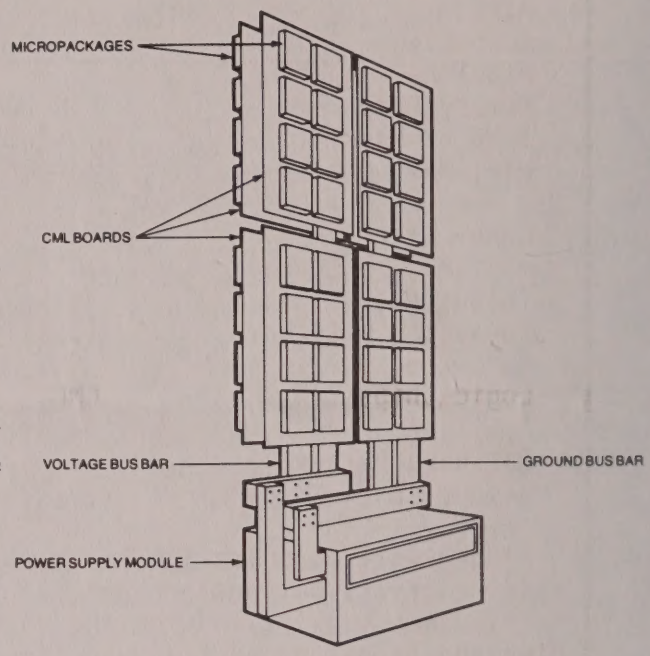
DPS 88 Circuitry rundown

Perhaps the most significant hardware aspect of the new Honeywell line is the company's commitment to a micropackaging concept similar to that used by IBM in the Thermal Conduction Modules (TCMs) used for all of its 308X CPUs.

Honeywell's Micropackages are not as dense as those of IBM. The package itself is 3.2" square and contains an average of 70 chips. By contrast, the IBM package is 3.5" square and contains up to 133 chips. But Honeywell boasts that its CML technology is roughly five times faster than TTL circuits which IBM uses, and thus on a performance basis its packages are competitive. It also noted that its micropackaging densities can be improved for future machines relatively easily.

DPS/81 PROCESSOR UNIT



The new packaging is vastly superior to the circuit boards used in the past. Honeywell says that each micropackage can replace two 12" circuit boards and requires much less power. A typical DPS/81 (see figure) consists of 32 micropackages, mounted in four groups of eight; it measures 27" x 44", and contains more than 300,000 logic gates.

All told, the logic circuitry is some 30 times denser than in the DPS 8s, announced in October of 1979. This presents new cooling problems. Honeywell says air cooling cannot guarantee the low temperatures needed for high reliability and circuit longevity; thus the DPS 88 circuitry is water cooled. The use of water does not, however, require plumbing facilities; an air dissipation system is available. IBM offers a similar water-to-air system on its 3083s.

The use of CML chips is also significant. The much ballyhooed technology had previously only surfaced in the DPS 7 made by CII Honeywell Bull. But Honeywell now believes it can cost effectively build CML chips at its Solid State Electronics Division. Honeywell officials indicated that they expect that IBM will also introduce CML-based products in the near future. NEC is the only other mainframe vendor known to be using CML.

Unlike TTL circuits which basically use an on/off approach, CML circuits route currents without altering their values. It is similar to ECL in that both use a differential amplifier, but CML has only two transistors per circuit, while ECL requires four. Honeywell also claims that CML requires 40% less power than TTL.

Honeywell says that a full 25% of the machine's internal logic is dedicated to reliability and integrity features, a significant increase. It calls its NFT (native fault test) procedures a major improvement in error detection and correction. NFT uses bit-pattern testing similar to that used by IBM. Both systems check for specific bit patterns to test specific circuits, rather than having to run through time-consuming functions such as addition, multiplication, division, etc.

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DPS 88 SUMMARY DATA

	DPS 88/81	DPS 88/82	Redundant DPS 88/82
Number of CPUs	1	2	2
Performance x DPS 8/70 (GCOS 8)	3.5-4.5	6.3-8.1	6.3-8.1
MIPs	7.2	13	13
Addressing	26/43	26/43	26/43
Pipeline Stages	5	5	5
Memory Chips	64K RAM	64K RAM	64K RAM
$/MB of Memory	$25,000	$25,000	$25,000
Min.-Max. Memory	16-64MB	16-128MB	32-128MB
Cache Size	64KB	128KB	128KB
Min.-Max. # Channels	10-40	10-40	20-80
Throughput	48MB/sec	48MB/sec	96MB/sec
Formatted Disk/Unit	1.1GB	1.1GB	1.1GB
Formatted Disk/Actuator	550MB	550MB	550MB
Logic Chips	CML	CML	CML
Available	4Q/83	4Q/83	4Q/83
Purchase Price*	$2,850,000	$4,050,000	$4,759,000
4-year Lease Price*	$91,200/Mo.	$141,000/Mo.	166,000/Mo.

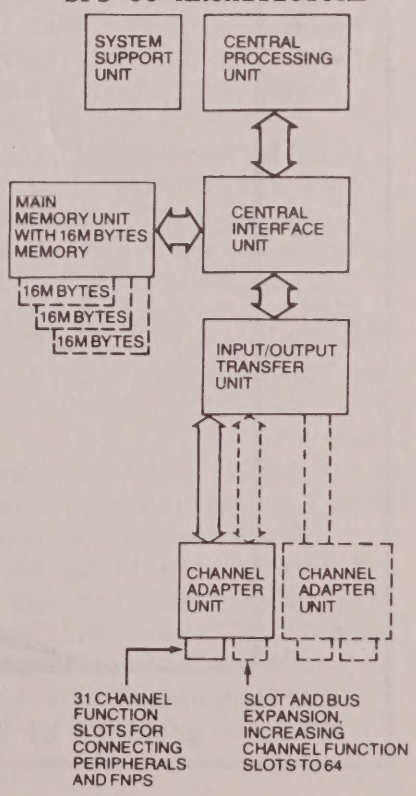
*Honeywell purchase and lease prices for the DPS 88/81 include: CPU; 16MB main memory; I/O transfer unit; 31 channels; a systems support facility; console; power supply; and cooling unit. The dual DPS 88/82 has the same items plus additional support and cooling units. The systems support unit is a DPS 6 mini which does the diagnostics and resource management. Memory is available in 16MB increments. No major new peripherals have been introduced.

Although the DPS 88 can boast of some impressive new technology, a spokesman at Honeywell's large system division in Phoenix said that the company considers the GCOS 8 architectural improvements more significant.

Honeywell is emphasizing its new five stage pipelining architecture, which it says allows the DPS 88 under GCOS to simultaneously work on as many as 16 instructions. There are also two separate caches, one for instructions and one for data, and Honeywell claims that its cache hit ratio is 95%. DPS 88 support for Multics and CP-6 is promised for the future. According to Honeywell, GCOS accounts for over 90% of its mainframe installations; CP/6 (the old Xerox base) and Multics share the remainder roughly equally, with Multics having a slight edge.

As part of a new GCOS 8 release, a new operating mode has been announced. Hypermode allows the user to separate the system support features from the GCOS 8 software, effectively creating a virtual machine. Honeywell officials stressed, however, that this is at this time strictly a service tool and any discussion of dual operating systems would be premature.

DPS 88 ARCHITECTURE



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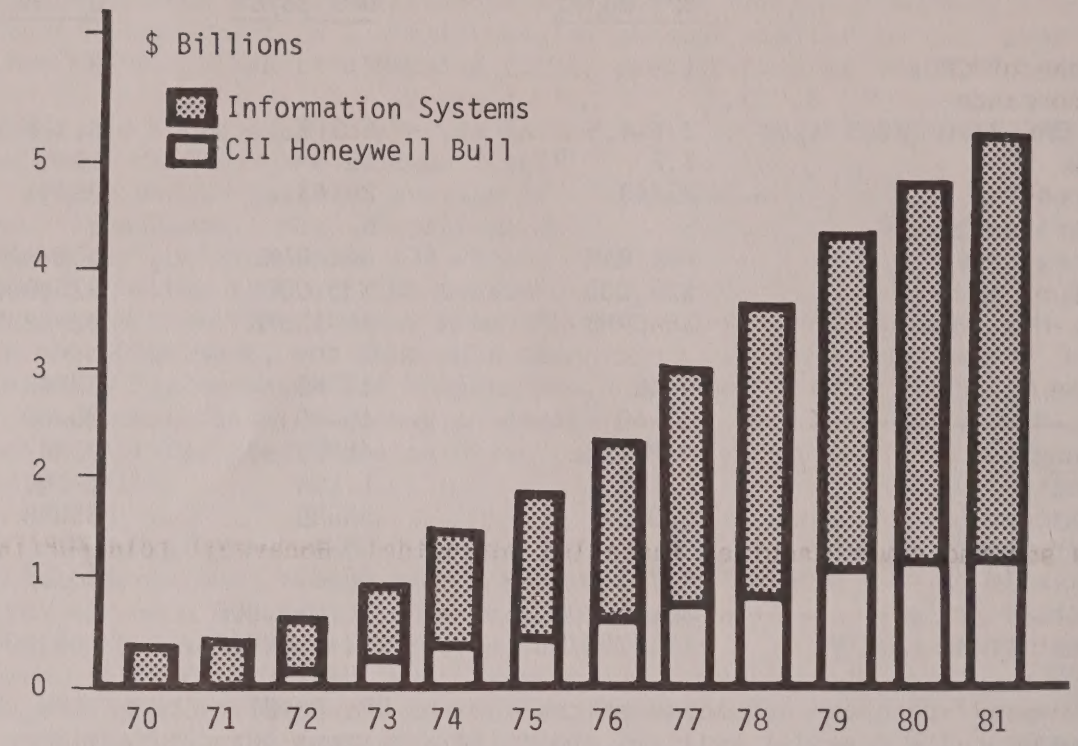
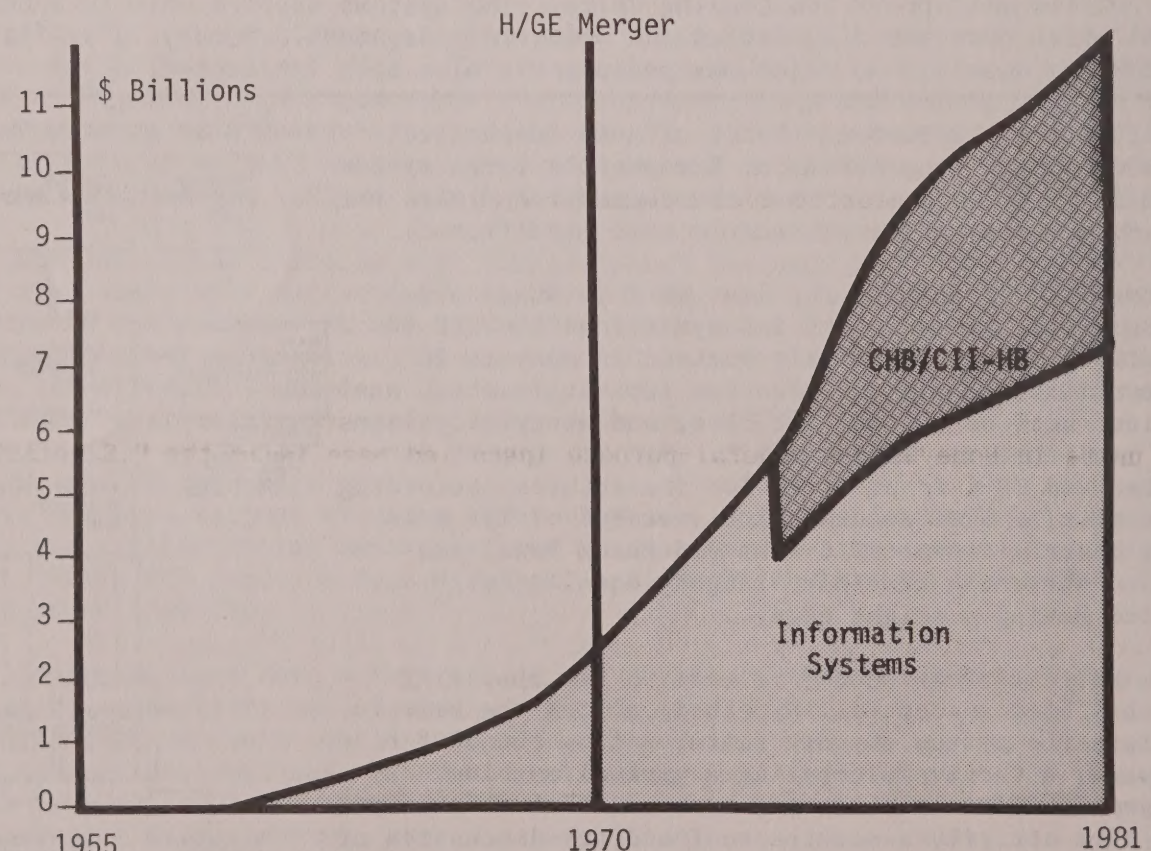
VALUE OF HONEYWELL MAINFRAME INSTALLED BASE, 1970-1981*



VALUE OF HONEYWELL INSTALLED BASE, ALL SYSTEMS, 1960-1981*



*Figures provided by Honeywell.

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HONEYWELL INFORMATION SYSTEMS FINANCIAL PERFORMANCE, 1977-1981

	1981	1980	1979	1978	1977
Revenues ($M)	$1,773.7	$1,634.1	$1,452.6	$1,293.6	$1,036.9
Adjusted Revenues*	1,773.7	1,803.6	1,820.1	1,803.3	1,556.2
Operating Profit	158.3	183.5	148.8	104.0	79.1
Assets	1,371.4	1,340.6	1,204.7	1,096.1	943.0
Assets/Revenues	0.77	0.82	0.83	0.84	0.91
Return on Assets	11.5%	13.7%	12.3%	9.5%	8.4%

*Adjusted revenues calculated by using consumer price index to put past five years into 1981 dollars. Return on assets calculated by dividing the operating profit by the total assets. Revenue, asset, and profit figures from 1981 Honeywell annual report, and do not include CII Bull figures.

Honeywell's mainframe market view

IDC estimates that as of the end of 1981, Honeywell had some 1,000 size class six and seven machines installed worldwide. Honeywell told EDP/IR that its best estimate is that the overall power requirements of this group will expand at 27% per year through 1987, which will be the approximate life span of the DPS 88 family.

How many of these customers will move up to the DPS 88s is, of course, a matter of conjecture. A Honeywell spokesman indicated that the company is prepared to build about eight machines per month once production is underway. Given the size of their base, 100 machines per year does not seem an unreasonable estimate.

Although the DPS 88s are primarily being built to satisfy existing customers, Honeywell pointed out that CII Honeywell Bull believes that it will be able to attract significant new business in Europe. In fact, Honeywell executives remain enthusiastic over relations with CII despite the fact that the French nationalization effort has reduced Honeywell's share in CII to 19.9%.

They point out that although CII lost money in 1981, with revenues of $1.4 billion it is a sophisticated company that is important to Honeywell for both its R&D capabilities and as an outlet for Honeywell products. The European market has always been very important to Honeywell, and Honeywell has a strong base of size class four and five machines in Europe. (Overall, only 19% of the units in Honeywell's general-purpose installed base is in the U.S.) IDC believes that over the next five years, Europeans will show more interest in size class six and seven machines than they have in the past, and Honeywell is in a position to benefit from this movement.

Honeywell continues to support both industry standards and IBM's SNA. It believes that the era of the one vendor shop is steadily disappearing, and says that it already has ten customers using 30 to 40 of Network Systems' Hyperchannel adapters to connect mainframes and peripherals of different vendors. SNA support is also becoming more widely used and is a key to Honeywell's minicomputer and distributed processing strategies. Honeywell achieves SNA compatibility by emulating IBM SNA terminals. The company does not believe it is particularly urgent to support SNA beyond level three of the ISO model; the key is data access, not sharing applications.

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BUSINESS GRAPHICS MARKET HEATS UP; DESKTOPS LEAD WAY, AS VENDORS SCRAMBLE FOR PRODUCTS

As soon as some considerable obstacles are overcome, business graphics equipment, software, and services should be able to enjoy a long ride atop the growth in distributed resource systems. Simply put, anyone who is using Visicalc today is a prospect for graphics tomorrow.

Though the market will be large, putting dollar labels on it has its hazards. Most graphics capabilities will be part of multifunction systems performing everything from data entry to text processing. To count only the value of the graphics software would understate things, counting the whole system would overstate it. The same is true on the output side, as a new generation of non-impact printers becomes capable of reasonably clear graphic output in addition to normal printing tasks. Standalone graphics equipment used in centralized environments is still a major part (60%) of the market, but the need for sharing will shrink as non-impact and laser printers fall in price.

Vendors have realized that graphics are an important marketing tool, and are scrambling to get products out into the market. Some recent moves show Wang contracting with Precision Visuals, Fortune licensing software from the IMJ Software Center, and HP merging text and graphics on its laser printer. There is also lots of action in the turnkey system and OEM arenas.

Although graphics packages on minis, and service bureau offerings remain popular options, it is clear that desktop computers will become the dominant market force. Not only do graphics appeal to unsophisticated users, but they can be of great value to the business and professional users who are buying high-end desktop systems. Some 59% of all business graphics output is used by middle and upper management. Graphics is also an area where vendors can seek a competitive edge in what often looks like a "me too" personal com- puter market. Yet despite the plusses, several factors are preventing wide market acceptance. Among them:

- Compatibility. Often desktop graphics are not "table-driven," meaning the graphic parameters must be rekeyed. Grid Systems offers a good of example of table-driven graphics capability. Also, among major vendors, only the Xerox Star smoothly combines text and graphics on the CRT screen.

- Overhead. Good formatting programs, variable fonts, and stored images chew up lots of memory and CPU time. HP's 2700 graphics terminal contains a Motorola 68000, an AMD 2901, and 1MB of memory. Convergent Technology adds a second 8086 for graphics on its IWS line. The heart of the Xerox Star is considered proprietary.

- Output. High resolution screens and color printers can significantly increase system costs, but low-cost laser printers and bit-mapped screens are coming. IDC believes that shipments of medium speed printers (faster than 0.5 pages/ minute, slower than 1 page/second) will grow at 61% per year through 1986.

- Data manipulation. Users want to be able to get data from a central data base and then manipulate it locally. Smooth links to mainframe systems are just now beginning to be built.

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THE U.S. GRAPHICS MARKET, 1981
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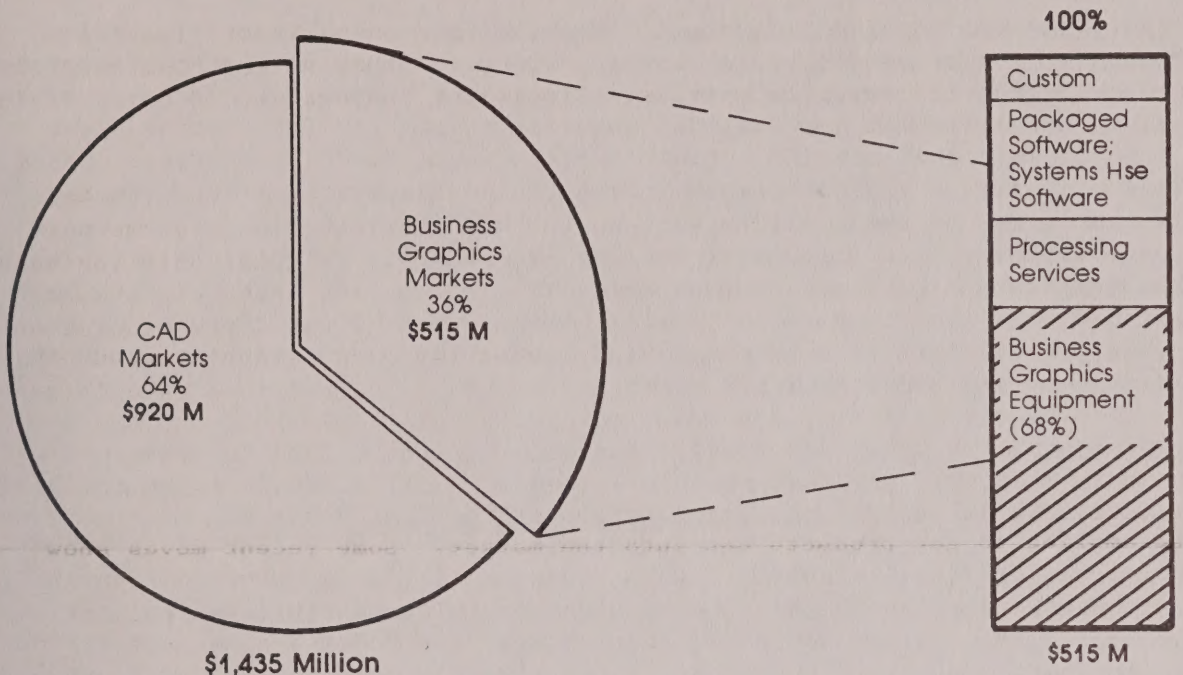

As the chart shows, engineering functions still comprise the largest part of the market. The "business graphics equipment" market consists primarily of displays and output devices -- both printers and plotters -- although some dedicated desktop computers are included.

MARKET SHARES OF GRAPHIC OUTPUT DEVICES, BY TECHNOLOGY
WORLDWIDE SHIPMENTS, 1979 & 1986
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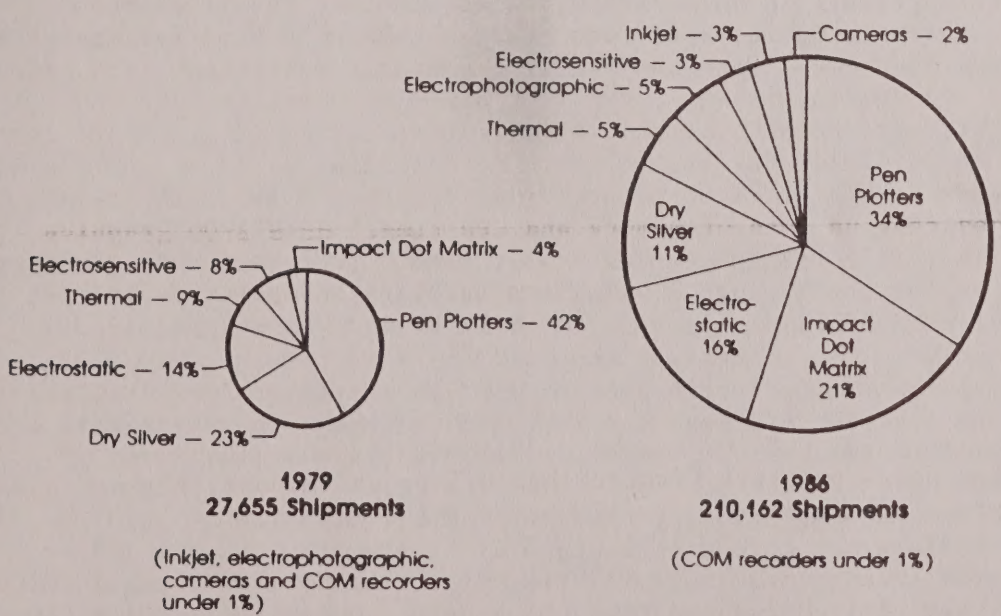

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• IBM LANDS BIG INSURANCE CONTRACT. Besting five competitors, including AT&T, IBM will over several years install a network that will allow independent insurance agents to communicate to large insurance companies. The so-called Insurance Communication Service will make use of the IBM Information Network and IBM has said that non-IBM hardware will be able to use the system. Wang, DEC and Microdata are particularly strong in the insurance agency market. In a few years, the system could support up to 60,000 agents and 200 companies. Network management will be one of the key battlefronts between IBM and AT&T. AT&T's proposal is believed to have been hurt by the fact that its Net 1 (now called Net 1000) was only recently announced. Other bidders for the contract included Control Data, Electronic Data Systems, ISA Communications Services, and National Computer Software Systems.

• UNIVAC DOUBLES SYSTEM 80 POWER. Announced at the Univac European users meeting in Helsinki, Finland, the new System 80 Model 8 offers twice the power and memory (up to 8MB) as the previous top-of-the-line Model 6. It also supports up to 120 workstations (three times its predecessor), and 2.4 times the disk storage (up to 11 gigabytes). The machine will also serve as a badly needed growth path for 90 OS/3 users, with special compatibility features that allow most OS/3 programs to run without change; the Model 8 also supports many 90 series peripherals. The product is the first to come out of the joint development effort between Univac and Mitsubishi Electric. A basic system including CPU, console, 1MB memory, one 491MB disk drive, a diskette drive, a 180 lpm printer and basic system software is priced at $204,056, or $5,804 per month on a five year lease. First customer deliveries are not scheduled until the first quarter of 1984, however.

• NEC SAYS FOUR MEGABIT RAM IS POSSIBLE. Nippon Electric says that it has developed a series of new semiconductor processes that will enable it to make memory chips nearly 100 times as dense as today's 64K technology. Papers on the new technologies were scheduled to be read at the International VLSI Symposium in September in Japan and are also scheduled for the upcoming International Electronic Device conference this December in San Francisco. NEC says that commercial development may still be several years away.

• AT&T SPEAKS AT INFO. Archie McGill, Director of Advanced Information Systems at AT&T spoke at the recent Info '82 in NYC. Among the tidbits offered the attendees: 1) Net 1000 (formerly called Net/1) has been so well received that it will be in a capacity bind for some time. AT&T has stepped up its orders for both the VAX and Series 1 gear used, and a series of new features will start to unfold next year; 2) AT&T has no plans to market computers; it will emphasize communications processing with "DP-like" services; 3) 50% of senior management will use a terminal regularly by 1990, compared to 0.5% today; 4) the technology either in the labs or available today will be sufficient to handle the tasks of the next ten years; 5) voice store-and-forward and fiber optics will become very important in the "relatively near future."

• MAGNUSON ANNOUNCES 4321 COMPETITOR. The new M80/20 is said to offer 10% greater performance than either the 4321 or the 4331-1, with prices 30% lower. The machine is available 30 days after order and is priced at $59,000. IBM has, however, introduced two new 4300 models and has cut 4300 prices by 8% to 34%. System/38, 8100 and 5280 prices were also cut. Details next issue.

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IBM ADDS NEW 3081 AND 3084; PCMS FILL OUT LINES, CUT PRICES

Score one for IBM, one for the PCMs. IBM can claim that its 3084 is the biggest and fastest 370-type machine available: while both Amdahl and NAS have approximated the breadth of IBM's 308X family, with the usual price discounts.

Yet despite the headlines, little new hardware has actually been introduced. IBM's 3084 is basically two 3081Ks glued together through "additional circuitry." Its 3081G is a reworked 3081D that is technologically closer to the other members of the 308X family.

On the PCM front, only Amdahl is offering its customers a new option. Its 5850, which has been quietly marketed in Europe for about six months, will compete with the 3081G. National Advanced Systems, despite three new models, has not changed its line-up significantly. Processor performance for the new 9040, 9050, and 9070 is identical to that of the 9000N, 9000, and 9000DPC, respectively, with little change in price. Unlike their predecessors, however, the new 9000 machines will support IBM's forthcoming extended architecture.

Combined with MVS/XA, the 3084 will allow IBM users to take advantage of four-processor configurations and more than 32MB main memory for the first time. It also automatically doubles the amount of processing power that can be focused on a single job, and is symbolic of the rapidly escalating power competition, often referred to as the "MIPS war." Some other points of note:

- IBM's unusually low 308X price/lease ratios reflect either a need for cash or a shorter than normal lifetime for the 308X series.
- Field upgradeability is such a part of both the IBM and PCM lines that the used market will inevitably shrink.
- For the first time, IBM is making a claim of redundancy. Because the 3084 duplicates critical hardware, IBM says that it is "generally capable of continuing operation while failing portions are isolated, repaired, and returned to the operating configuration."
- Amdahl says volume shipments of the 5860 will commence this quarter; only one has been shipped thus far.

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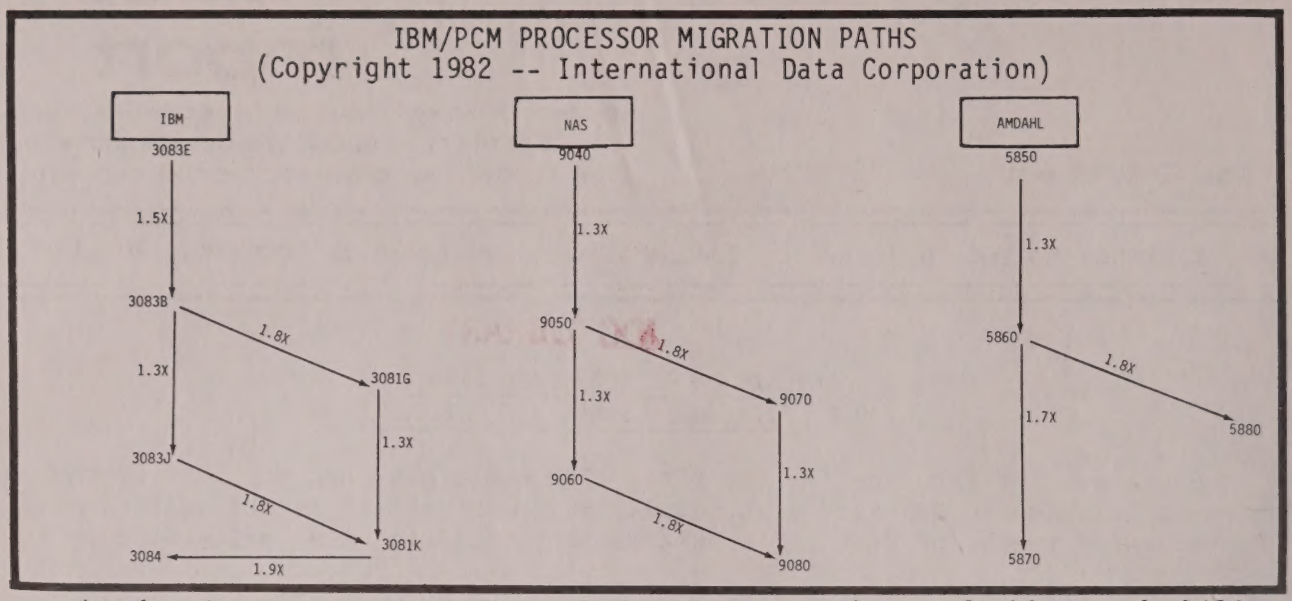

As the chart shows, both IBM and the PCMs are offering field upgradeability throughout the line. As a rule, the user pays no penalty for starting small and working up the line. Whatever path the IBM user takes, purchase looks the most attractive. However, on October 4, IBM Credit Corporation announced that it will also write leases on the 308X family. IBMCC rates are not yet available, and it will be interesting to see whether or not these rates differ substantially from the parent's.

PCM leasing rates are priced more attractively. Overall, the price/lease ratio for Amdahl's 58XX family is 35; for NAS the figure is 41; and for IBM the figure is 31. For the 3081s, the IBM ratio ranges from 29-31 depending upon model number. The low IBM numbers have fueled speculation over the longevity of the 308X line, and whether IBM will need even bigger machines to keep pace with what's on the drawing boards of Amdahl, Fujitsu, and Hitachi.

EDP/IR asked Amdahl and NAS whether they intended to bring out four processor versions of their respective 5860 and 9060 machines. If such machines were made available, the PCMs could shoot far past the power of the 3084. A simple multiplier of 1.8 over the current dual processor systems would yield IDC relative performance ratings of 1,650 for NAS and 1,950 for Amdahl, well in excess of the 3084's 1,250. In terms of MIPS (Millions of Instructions Per Second), such systems would put the PCMs in the 30-40 range. Trilogy is still talking about a machine in excess of 50 MIPS by late 1984.

NAS will probably go the four-processor route. A spokesman said that although the company is not ready to announce such a product, it does feel a need to eventually exceed the 3084's performance, and that IBM's blessing of quadratic processors makes this a reasonable path. He added that he could see no technological reason why NAS/Hitachi couldn't deliver such a configuration. (The same spokesman added that the new 9000 machines incorporate many microcode changes and have faster cycle times, but are not totally new machines.)

A spokesman for Amdahl said that the company has not yet decided on its approach to future large systems. Noting the decreasing efficiencies of MP arrangements, he noted that it may be easier to just build a better single CPU. Amdahl has grown accustomed to having the biggest machine on the block, and EDP/IR expects some type of action to reclaim this position.

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LARGE-SCALE IBM-COMPATIBLE PROCESSORS, RANKED BY POWER
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Vendor	Model*	Price** ($000)	Date Avail.	IDC Perf. Rating	Purchase Price/ Rating	4-Year*** Lease ($)	Purchase/ Lease
IBM	3083E	1,700	2Q/83	185	9,189	42,960	33
IBM	3083B	2,400	1Q/83	277	8,664	65,460	33
NAS	9040	2,300	1Q/83	314	7,324	68,040	38
IBM	3083J	3,000	1Q/83	370	8,108	84,860	33
NAS	9050	2,900	4Q/82	393	7,379	73,185	45
IBM	3081D	3,540	4Q/81	465	7,612	110,485	31
Amdahl	5850	2,750	2Q/83	465	5,913	80,995	38
IBM	3081G	3,540	4Q/82	500	7,080	110,485	31
NAS	9060	3,500	3Q/82	510	6,862	94,380	41
Amdahl	5860	3,150	4Q/82	620	5,080	100,541	35
IBM	3081K	4,290	2Q/82	675	6,355	136,400	30
NAS	9070	4,200	4Q/82	708	5,932	110,000	42
NAS	9080	6,000	4Q/82	920	6,521	157,820	42
Amdahl	5870	5,200	3Q/83	1,055	4,928	168,874	34
Amdahl	5880	6,200	2Q/83	1,085	5,714	197,415	35
IBM	3084	7,900	1Q/84	1,250	6,325	278,800	30

Notes. *All processor configurations include 16 megabytes of main memory and 16 channels, except for the IBM 3084, NAS 9080, and Amdahl 9080 which include 32MB memory and 32 channels. **Purchase price includes all necessary console and cooling unit hardware. ***Four-year lease prices for IBM are for the CPU only, not the purchase price listed above.

The extra spacing divides the hardware as follows. The first set is classified by IDC as size class six machines; the second is single box size class seven machines; while the third includes multiprocessor size class seven machines. IBM's 3081D, 3081G and 3081K contain two processors in one box. IDC performance ratings are relative measures: the actual number is only useful for comparisons with other IBM compatible machines. As for the price/rating number (column 6), the lower the number, the better the price/performance.

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PRICING STATUS

The latest round of price reshuffling allows the PCMs to claim more for less, but not in all cases. For NAS, its prices in the class six range are about 13% less than those of IBM, but in class seven and in multiprocessing configurations, NAS prices are only about 2% lower than those for IBM, much less than the traditional PCM margin. For Amdahl, the situation is different. Its size class seven prices are some 20% lower than IBM's, but unfortunately only the 5860 is being delivered, and even that is just beginning. The rest of the line will not surface until the second and third quarters of 1983.

Average prices have been calculated using the data in column six of page three. The numbers for each vendor in a particular size class have been added and an average then taken. IBM's 3083E was not included because neither Amdahl nor NAS have a new machine in this range.

3084, 3081G details

The 3084 is an add-on box to a 3081K. Together the system can run under either a single copy of the MVS or it can be partitioned into two virtual machines. In a single-image configuration, the 3084 is supported only by MVS/XA, while in a partitioned set-up, it can act like two 3081 processors. When using s single operating system, the 3084 can support up to 64MB and 48 integrated channels. The 3084 is available only as an upgrade to an IBM 3081K. Users who have a 3081K on order can also order a 3084, and the two could be delivered simultaneously if the customer wanted.

Although IBM says that "when partitioned the 3084 has performance approximately equivalent to two 3081 Processors Model Group K," the company will not say that the 3084 consists of two 3081Ks plus the connecting circuitry. (The price of the 3084 is virtually identical to buying two 3081Ks.) Building off this stance, IBM says that if a customer with two installed 3081Ks wanted to join them into a 3084, an RPQ could be requested, but at this time IBM has not guaranteed that it would comply.

Financially, there is one clear reason why IBM would not want to do this upgrade. Because the 3084 has a single serial number and is considered a single machine, users only have to buy one copy of IBM licensed software, even if they are running the machine in a partitioned mode. The savings here can be substantial, with $10,000 per month a not unreasonable figure.

With the 3081G, IBM is effectively replacing the 3081D which fell far short of the price/performance of the 3081K. IBM has said that the processor complexes for the 3081G and 3081D are identical except for the processing unit which contains more advanced technology. EDP/IR suspects the TCMS (thermal conduction modules) have been upgraded from the 118 chips/module in the /D to the 133 chips/module in the /K, but IBM would neither confirm nor deny this.

To help calm early 3081D buyers who may now feel that they got burned, IBM is offering a special upgrade price to the 3081K if the upgrade is installed before year-end 1983. Qualified users can save $200,000 on the upgrade, but this is not enough to give them equivalent price/performance with 3081K buyers. EDP/IR would not be surprised if IBM offers a dual version of the 3081G. Such a machine would have an approximate rating of 900, nicely filling the large gap between the 3081K and the 3084.

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ADJUSTMENTS FOR INFLATION SHOW MAINFRAMER PRODUCTIVITY INCREASING 2% PER YEAR 1969-1981

Although substantial inflation has been with us for more than a decade, the money illusion persists. Measures of output/worker and yearly figures show nicely rising paths when expressed in current dollars, but when the effects of inflation are accounted for, the curves flatten, and the performance of U.S. mainframe companies does not look so impressive.

What follows is a series of charts that contrast the nominal (current) to the real (deflated) data. EDP/IR has chosen to use the Department of Labor's GNP price index over the 1969 to 1981 timeframe. Over this twelve-year period, the average annual inflation rate was 7% per year compounded. If 1969 is used as a base year of 100, then 227 would be the equivalent amount of 1981 dollars. In other words, the price level has jumped 2.27 times.

Naturally, the use of different indices would yield slightly different results, but the GNP deflator is considered the most reliable indicator of industry trends. Use of the Consumer Price, Producer Price, or Personal Consumption indices would yield average compound rates of 8%, 8%, and 7%, respectively, although the numbers for specific years can vary substantially between indices.

The following analysis uses IBM, Burroughs, NCR, Control Data, and Digital Equipment annual report data over the 1969-1981 period. Univac and Honeywell were not included because of the difficulties in segmenting their computer business' assets and number of employees from the corporation as a whole, especially in the earlier years. Despite its mainframe revenues, DEC's story is primarily one of minicomputers. Some of the key points of interest:

- In terms of revenues per employee, IBM is the hands down winner, often as much as fifty percent higher than the competition. The ratios for the other vendors sampled are remarkably similar to one another. In real terms, using this measure, overall revenues/worker have increased about 2%/year over the last ten years, compared with 10% in nominal terms. (See charts 1 & 2.)

- The use of real dollars makes the growth of DEC even more impressive. In real terms, DEC has grown five times as fast as IBM over the last twelve years, compared to only three times in nominal terms. In contrast, the use of real dollars, makes NCR's performance look unimpressive with real growth of just over 1% per year over the 1970-1981 period. (See chart 3.)

- From a user perspective, on a dollar per MIP basis, the use of real dollars accentuates the already falling cost of computing power. Even during the high inflation of the last five years, both the real and the nominal costs of computing power have continued to fall rapidly. (See chart 4.)

- In terms of dollars of assets/dollar of revenue, the vendors sampled are remarkably consistent. IBM and NCR have hovered tightly around the 1:1 mark; CDC has gradually pared its ratio down to the same point; while DEC has hovered in the 1.1:1 range. The only anomaly is Burroughs, which is in the 1.3:1 range. The assets/revenue ratio is not affected by inflation.

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CHART 1
NOMINAL REVENUES PER EMPLOYEE, SELECTED MANUFACTURERS, 1969-1981
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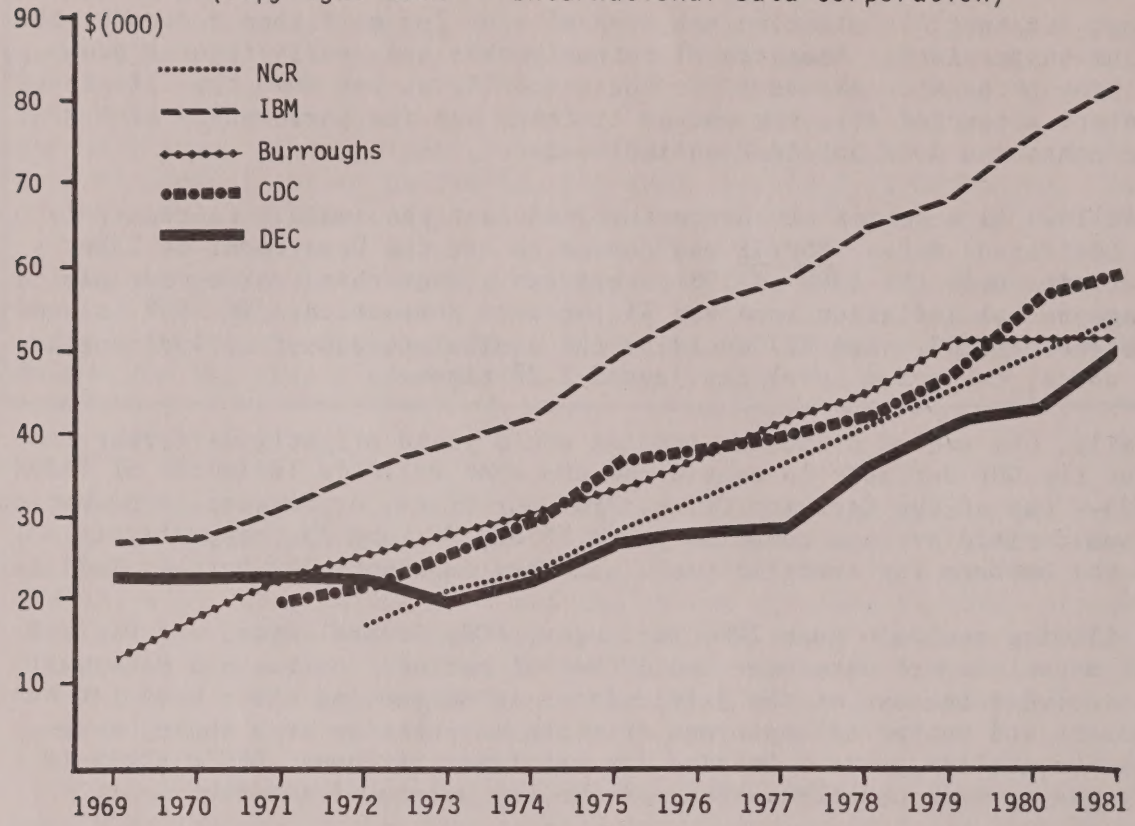

CHART 2
REAL REVENUES PER EMPLOYEE, SELECTED MANUFACTURERS, 1969-1981
(Copyright 1982 -- International Data Corporation)

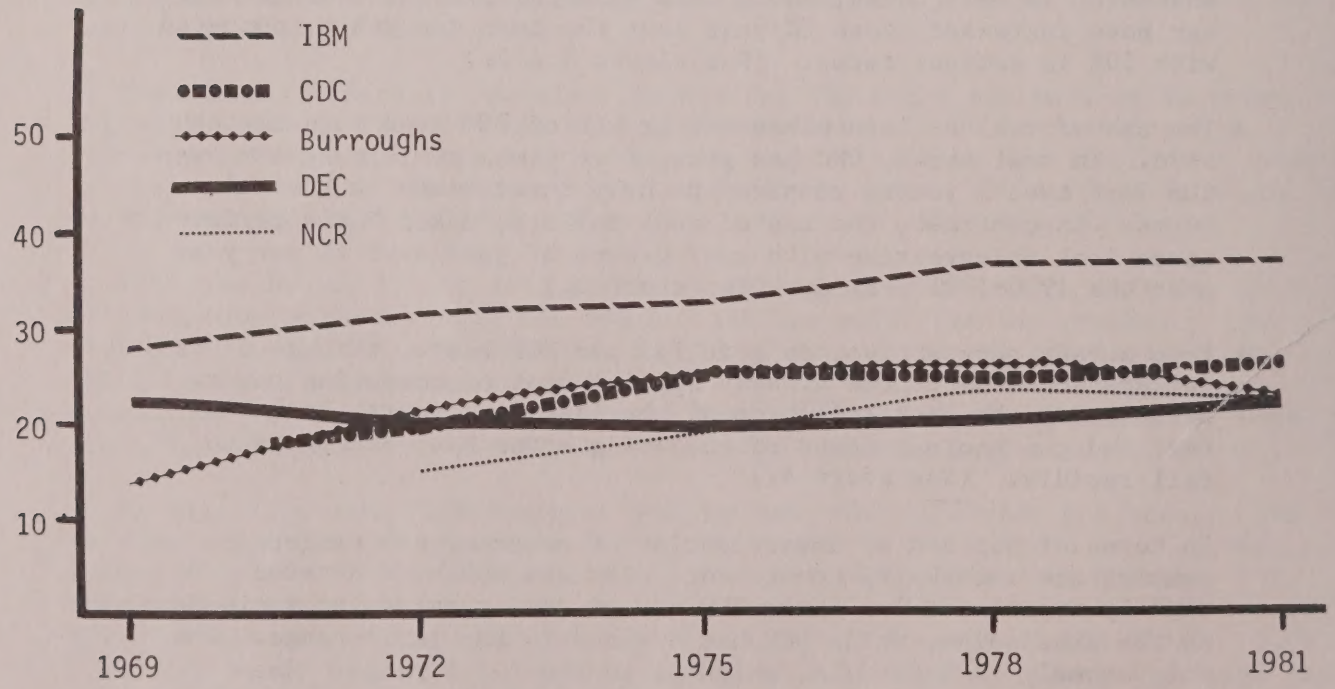

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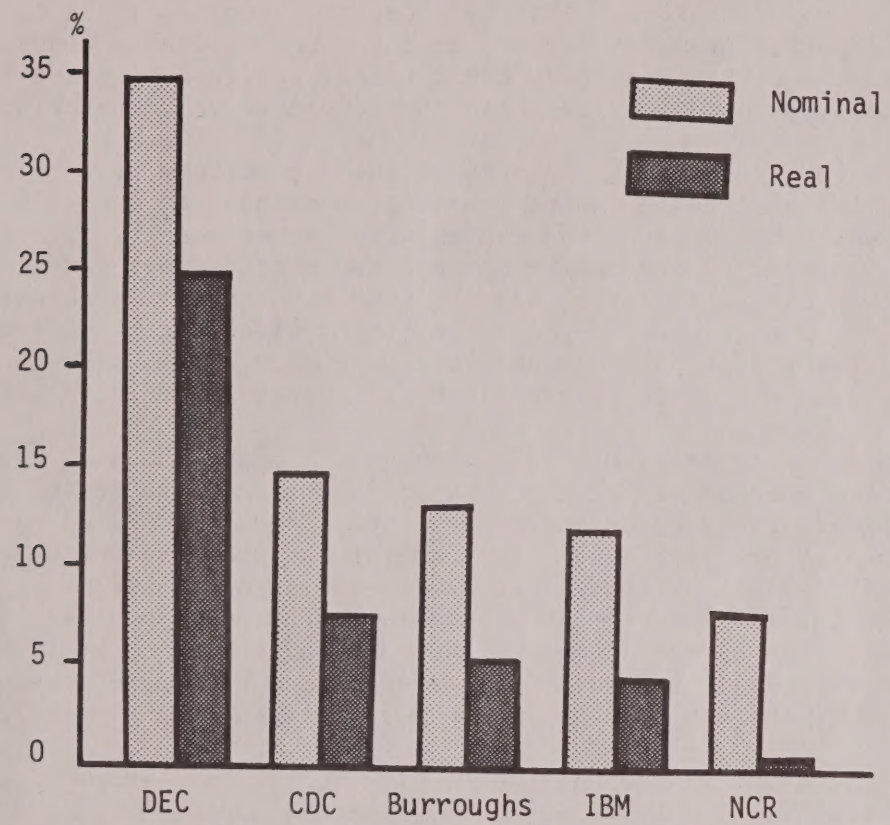
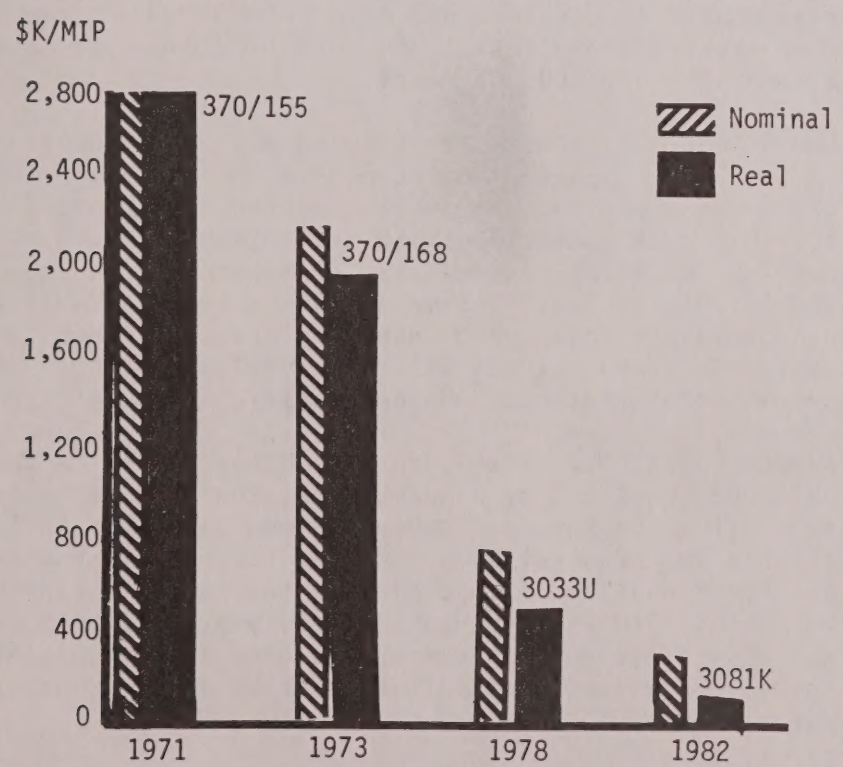
CHART 3
AVERAGE COMPOUND ANNUAL GROWTH RATES, NOMINAL vs. REAL,
SELECTED MANUFACTURERS
(Copyright 1982 -- International Data Corporation)



COST OF IBM COMPUTING POWER, NOMINAL vs. REAL, 1971-1982
(Copyright 1982 -- International Data Corporation)



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• TOP BRASS PULLS OUT OF XEROX. The bad news continues to come out of Xerox's Office Products Group. Shortly after the company agreed to spend some $1.6 billion for Crum and Foster, an insurance holding company, division head Don Massaro and Vice President David Liddle resigned to start Metaphor Computer Systems, said to be interested in the executive workstation market.

Despite Xerox's remarks to the contrary, the expenditure of such a large amount of capital does raise doubts over its commitment to the office equipment market, which has treated the copier king rather rudely. The company's line of word processors, personal computers and professional workstations has been unable to generate a profit, and its Ethernet local area network scheme has been slow to gather momentum. On the bright side, Xerox has installed an optical disk system designed to handle the vast card catalogs at the Library of Congress; Xerox claims it is the first such system ever installed.

• BURROUGHS ADDS MID-RANGE MACHINE. Though it is not the size class seven machine that the company is being pressured to produce, the new 4955 provides a powerful upgrade to users of Burroughs /2000, /3000, and /4000 machines. The 4955 is claimed to have 1.8 times the power of the previously high-end 3955; it occupies 65% less floor space, and air conditioning requirements have been halved. Scheduled for delivery in the third quarter of 1983, the 4955 will originally come with up to 5MB memory, but Burroughs says up to 10 MB will eventually be made available. Up to four 4955s can be linked together. Prices start at 780,000, and one, three, and five-year leases are available.

• GTE GOES AFTER SOUTHERN PACIFIC COMMUNICATIONS. In a surprisingly aggressive move, GTE will, if the FCC approves, purchase Southern Pacific's long distance communications division for $750 million. If the deal goes through, GTE, the nation's second largest telephone company, would be in a position to compete directly with AT&T in the long-distance telephone business; GTE would also pick up SPCC's satellite business. SPCC had 1981 revenues of some $234 million, and has more than 400,000 customers.

• PRIME AIMS LOW END 32-BIT MACHINE AT OFFICE MARKET. In the range of DEC's 11/730, the new Prime 2250 is geared to the hybrid DP/WP arena. The system can support up to 32 users and can come with a maximum of 4MB main memory and 632MB of disk storage; it is compatible with all Prime 50 series machines. Prime is also building its first terminal, an ergonomically designed block mode device with graphics capabilities. Volume discounts are available on both products. The company used the occasion to announce its commitment to support IBM's SNA. Plans for SNA capabilities will be revealed over the next two years, with the emphasis on emulating SNA terminals.

• HONEYWELL HAS NEW PRESIDENT. Less than three years after he took office, Stephen Jerrits has been replaced by James Renier, the head of Honeywell's control business. During the summer, number two man James Berret left Honeywell to take the reins at Computervision. Renier has been with Honeywell since 1956 but has spent nearly all that time on the controls side of the business. However, from 1970-74, during the early years of the Honeywell/GE merger, Renier was vice president of Honeywell's data systems division. Honeywell will soon unveil a new series of mainframes that stack up against the IBM 308Xs and the Univac 1100/90 family.

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REVIEW & FORECAST
Part II

"The Gray Sheet"

EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

MOLLY UPTON, EDITOR SEPTEMBER 22, 1982 ● VOL. 18, NO. 10, 11 P.J. MCGOVERN, PUBLISHER

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1982 COMPUTER SHIPMENTS HOLD FIRM DESPITE RECESSION; VALUE TO RISE 15% TO $33.9 BILLION

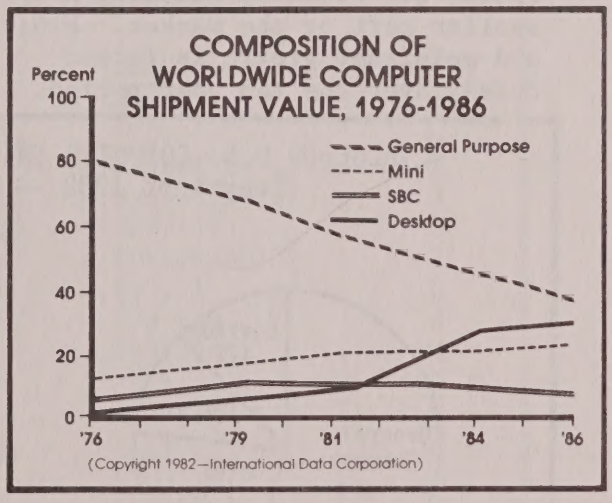
Despite a prolonged worldwide recession, the information processing industry continues to rack up impressive annual growth. Although there are several soft spots in the picture, International Data Corp., publisher of EDP/IR, forecasts substantial increases for all processor markets through 1986.

In 1981, U.S.-based manufacturers enjoyed a 52% growth in worldwide processor unit shipments. The total value of the 1,040,000 units shipped reached $29.4 billion, up 13% over 1980. Much of the action was at the low end, as desktop computers and 4300 sales were particularly strong.

Even though 1982 promises to be one of the economy's worst years since the Depression, users continue to show an almost insatiable demand for processing power. Strong sales of IBM's 3081s will be enough to prop up an otherwise flat general purpose market, while desktop computers and superminis continue to carry the sales of smaller systems.

From a global perspective, the U.S. market continues to pull away from the rest of the world. IDC expects that the value of shipments by U.S. manufacturers will grow at 18% per year in the U.S. compared to 14% internationally, as the U.S. market increases its share from 58% in 1981 to 63% in 1986.

The chart opposite shows how different the processor market will look by 1986. Mainframes, which accounted for 81% of the value of the 1976 worldwide processor market, will see their share fall to 40% by 1986, while desktops will rise from a mere 10% in 1981 to 29% by 1986. In fact, desktop computer shipments will pass those for minis in 1983, even though the overall share of minis will continue to rise.



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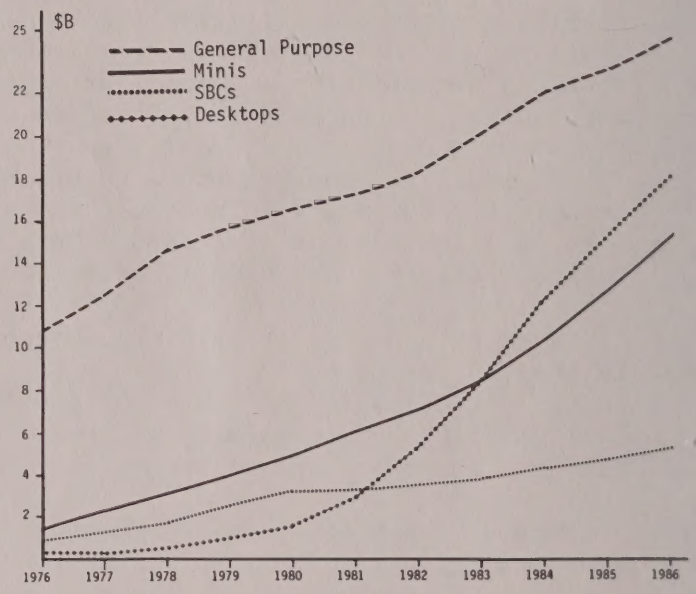
VALUE OF WORLDWIDE COMPUTER SHIPMENTS, U.S.-BASED MANUFACTURERS, 1981-1986
(Copyright 1982 -- International Data Corporation)

	1981 Worldwide Shipments ($M)	1986 Worldwide Shipments ($M)	Compound Annual Growth Rate
Mainframes	$17,360	$24,700	7.3%
Minis	6,180	15,355	20.0
SBCs	2,845	4,030	7.2
Desktops	3,006	18,286	43.5
Total	29,391	62,371	16.2

The chart on the right shows the steady progress of desktop computers, catching Small Business Computers (SBCs) in 1981, minis in 1983, and now taking aim on the mainframe market. In fact, IDC's aggressive desktop computer forecast sees the value of U.S. desktop shipments passing that for U.S. general-purpose computers by 1986 (see pie chart below.) In terms of units, by 1986 desktop computers will account for 93% of all worldwide shipments, up from 79% in 1981.

As the curves show, desktop computer success will come at the expense of SBCs, which like mainframes are steadily becoming a smaller part of the market. Mini and mainframe growth is rather steady over the ten year period.

VALUE OF WORLDWIDE SHIPMENTS, 1976-1986
(Copyright 1982 -- Int'l. Data Corp.)



VALUE OF U.S. COMPUTER SHIPMENTS, U.S. MANUFACTURERS, 1981-1986*
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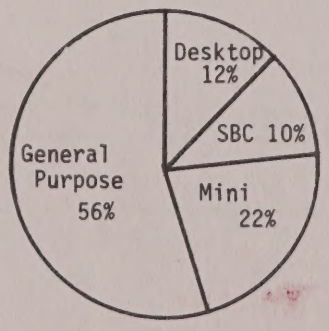
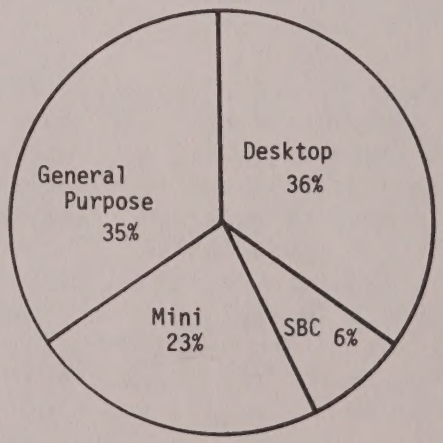


1981
$17,095M



1986
$39,113M

* The value of minis used in SBCs has been subtracted from SBCs to avoid double counting.

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Mainframes resilient

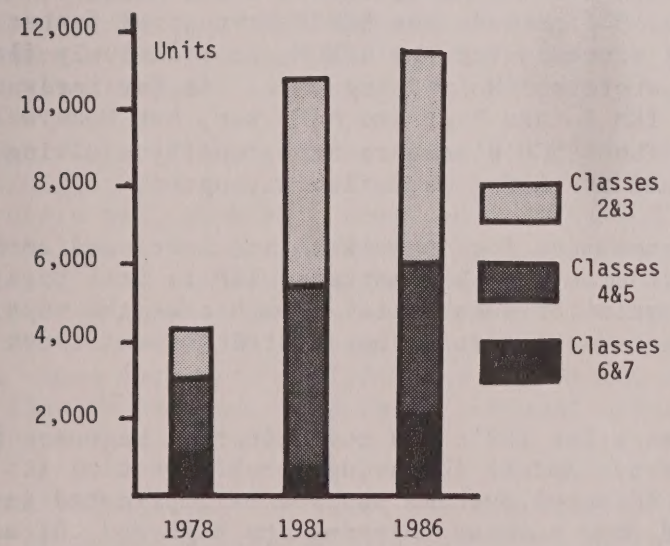
In 1981, shipments of low-end System/38s and Univac System 80s gave size class two a slight unit increase, but the market will remain sluggish until IBM introduces a follow-on for its large System/3 base. Size class three was down a bit as 4331-1 sales passed their peak, while 4331-2 and 4341-1 sales picked up, providing size class four with a comfortable gain. Thanks to strong shipments of the 4341-2, class five showed its first big year since the 370 era.

1981 was not a good year for size classes six and seven. Despite enticing price cuts, users were delaying 3033 purchases in anticipation of the 3081s and IBM did not really have much in class six other than the 3033S as a short-term filler. Non-IBM mainframers were similarly caught between product cycles. Consequently, class six and seven units and value were down from 1980 levels.

This situation will turn around in 1982 and beyond. In light of the economy, IBM is enjoying remarkable success with its 3081 line. Pent up demand for MIPS (Million Instructions Per Second) has put IBM in the enviable position of being able to ship all the big systems it can build, and IBM says it is making more than even it expected; 1982 shipments in the U.S. could exceed 500.

In 1982, IBM had to carry the ball alone, but in 1983 and beyond, new Univac and CDC lines will be in full swing and Burroughs and Honeywell will probably be joining them. In addition, shipments of IBM's 3083 series will begin in 1983, giving a big boost to size class six shipments. In fact, EDP/IR believes that because users can easily and economically upgrade from 3083s to 3081s, size class six will gather many of the 1983 and 1984 large system shipments, with many of these users migrating into class seven systems in 1985 and 1986.

U.S. GENERAL PURPOSE SHIPMENTS BY SIZE CLASS, 1978-1986
(Copyright 1982 -- International Data Corporation)



Size Classes for IBM CPUs

Model	Class
System/3-4,6,8	2
System/38-3	2
370/115	3
System/38-5	3
4331-1	3
370/138	4
4331-2	4
4341-1	4
370/148	5
4341-2	5
370/158	6
3031	6
3083	6
370/168	7
3033	7
3081	7

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INFORMATION PROCESSING REVENUES -- LEADING MANUFACTURERS ($M)
(Copyright 1982 -- International Data Corporation)

	1976	1977	1978	1979	1980	1981	Comp. Growth
IBM	13,400	14,765	17,074	18,338	21,367	24,073	12.4%
DEC (6/30)	736	1,059	1,437	1,804	2,368	3,198	34.2
CDC	1,358	1,513	1,868	2,273	2,791	3,101	18.0
NCR	1,674	1,944	2,240	2,634	2,951	3,072	12.9
Univac (3/31)	1,467	1,726	2,050	2,319	2,707	2,831	14.1
Burroughs	1,612	1,794	2,083	2,376	2,413	2,718	12.6
HIS	914	1,037	1,294	1,453	1,634	1,774	14.2
HP	461	588	769	1,060	1,510	1,771	30.9
Total	21,622	24,426	28,815	32,257	37,741	42,538	14.5

In 1981, Digital Equipment Corp.'s consistent 34% growth rate finally tracked down the members of the BUNCH (Burroughs, Univac, NCR, CDC, Honeywell). DEC vaulted from sixth place in 1980 to second in 1981, and since the minicomputer colossus shows few signs of slowing down, it will leave the non-IBM mainframers in the dust over the next few years. In fact, in 1982, Hewlett-Packard will shoot past Honeywell into seventh position. Lest any need a reminder of IBM's size, consider that at its average 12.4% growth rate, Big Blue adds nearly the size of a DEC to itself every year.

1981 and 1982 have seen a steady stream of questioning over the BUNCH's future, as the group has been slow to move into new, fast growing markets. Yet the data shows that over the 1976-1981 period, the BUNCH have grown faster than IBM. This will change in 1982 as revenues for the BUNCH are relatively flat and earnings are generally down, whereas IBM is doing well. As for hardware, Univac and CDC will compete with IBM in the high-end MIPS war, but Honeywell and Burroughs aren't committed. The BUNCH's members are steadily evolving new, more specialized strategies matched to their respective strengths.

The next few years should be good ones for IBM. With its continued emphasis on purchase and its desire to pursue any and all markets, IBM is well positioned to ride its 308X product cycle for substantial growth over the next few years, especially since the Reagan administration has lifted the antitrust monkey off IBM's back.

1981 and 1982 have been off years for IBM's PCM competitors. Magnuson is in financial and managerial disarray; Amdahl is having trouble getting its 5860s out the door; and National Advanced Systems may yet be implicated in the "Japanscam" scandal. NAS has had some success shipping its high-end, Hitachi-built 9000 series, and will probably join Amdahl in the PCM peripheral business. In June, IBM said it had delivered some 1,500 of its 3380 drives since October 1981, but it alone can't meet the full demand, and there is opportunity for anyone who can get a reliable 3380-compatible drive out on the market.

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WORLDWIDE NEW-BUILT SHIPMENTS, GENERAL-PURPOSE COMPUTERS
U.S. BASED MANUFACTURERS, 1979-1981
(Copyright 1982, International Data Corporation)

	1981			1980			1979	
	$M	% Total	%Δ	$M	% Total	%Δ	$M	% Total
IBM	10,920	62.9	7.3	10,180	61.2	3.6	9,825	62.3
Amdahl	350	2.0	-7.9	380	2.3	4.1	365	2.3
National	205	1.2	7.9	190	1.1	5.5	180	1.2
Magnuson	40	0.2	14.3	35	0.2	133.3	15	0.1
IPL	25	0.1	150.0	10	0.1	-	-	-
Cambex	*	-	-	-	-	-	-	-
Compatible Peripherals	1,015	5.9	45.0	700	4.2	9.4	640	4.0
Subtotal PCMs	1,635	13.0	24.3	1,315	11.4	9.6	1,200	10.9
TOTAL IBM BASE	12,555	72.3	9.2	11,495	69.1	4.3	11,025	69.8
HIS	1,220	8.3	-21.3	1,550	9.3	0.0	1,550	9.8
Sperry Univac	1,440	7.0	-1.7	1,465	8.8	-4.2	1,530	9.7
Burroughs	1,020	5.9	2.0	1,000	6.0	17.6	850	5.4
NCR	450	2.6	-6.2	480	2.9	23.1	390	2.5
CDC	390	2.3	-2.5	400	2.4	66.7	240	1.5
DEC	180	1.0	-12.2	205	1.2	36.7	150	1.0
Cray	105	0.6	110.0	50	0.3	11.1	45	0.3
Others	-	-	-	-	-	-	-	-
TOTAL NON-IBM BASE	4,805	27.7	-6.7	5,150	30.9	8.3	4,755	30.2
TOTAL	17,360	100.0	4.3	16,645	100.0	5.5	15,780	100.0

*Less than $2.5 million.

Changes in the mini market

1981 and early 1982 marked the beginning of several new directions for the minicomputer market. No less than Digital Equipment, Data General and Hewlett-Packard joined Prime in making major overtures to the office, while the major vendors recognized the importance of both personal computers and third-party software. Mini makers need new markets both to grow and to take advantage of the microprocessor technology which is driving the low end of the market.

Not that the outlook for today's mini market is all that gloomy. Led by superminis, the overall value of worldwide minicomputer shipments by U.S. manufacturers will grow at a compound rate of 20% over the 1981-1986 period, from $6.2 billion to $15.4 billion. Unit shipments will increase at a compound rate of 16.8% over the same period. In terms of the dollar value of worldwide shipments, the fastest growing sectors will be superminis (22%), traditional (17%), and microminis (16%). Even so, the value of worldwide desktop shipments will pass those for minis in 1983. No wonder DEC President Ken Olson called its new line of personal computers "the most significant products Digital has produced to date."

Due to both the recession and competition from desktops, worldwide micromini unit shipments decreased 12.2% in 1981, and will be relatively flat in 1982. Nevertheless the long-term outlook for microminis is bright, with IDC forecasting that overall unit shipments will increase at a compound rate of 18.4% through 1986, when microminis will be a $416 million market. OEMs continue to be the dominant marketing channel.

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Once the mainstay of the minicomputer industry, the traditional minicomputer market is now the slowest growing segment in terms of unit shipments. IDC expects that worldwide unit shipments of U.S. manufacturers will grow at just 13% through 1986. As with microminis, 1981 shipments actually declined, but traditionals will drop further in 1982. However, because of higher average system values and increasing software and services revenues, vendors should still enjoy significant overall growth.

EDP/IR believes that traditional mini growth will pick up as today's 16-bit systems move to a 32-bit architecture. The recent announcement of a low-end Vax is indicative of this new direction, but because it will take time to upgrade the software base, IDC does not see 32-bit systems having a significant impact on the traditional mini market until at least late 1983.

Shipments of 32-bit superminis, on the other hand, have carried much of the mini industry for the last few years and will continue to do so. Originally oriented toward the scientific/engineering customer, superminis are increassingly being used in commercial applications. This trend will continue as DEC, DG and others continue to offer more commercial software for their superminis.

In terms of worldwide unit shipments, superminis will grow at 21% per year, from 27,200 in 1981 to 70,800 in 1986. Perhaps more importantly, superminis will continue to increase their share of the value of minicomputer shipments from 63% today to 68% in 1986.

Because of its fast growth, the supermini market has attracted swarms of new competitors, including Stratus and Charles River Data. The market is getting crowded, and many vendors will either grab a special niche -- such as Stratus' redundancy -- or fall by the wayside.

WORLDWIDE MINICOMPUTER SHIPMENTS BY U.S.-BASED MANUFACTURERS, 1980-1981
(Copyright 1982 -- International Data Corporation)

	1980 $M Revenue	1981 $M Revenue	1981 % Share	1980 Units Shipped	1981 Units Shipped	1981 % Share
DEC	2,432	3,340	41.2%	77,560	73,080	49.0%
Hewlett-Packard	1,010	1,233	15.2	9,721	12,004	8.1
Data General	672	764	9.4	18,200	16,800	11.3
HIS	425	503	6.2	4,900	4,000	2.7
Texas Instruments	243	402	5.0	13,770	10,910	7.3
Prime	268	365	4.5	1,651	1,799	1.2
IBM	350	356	4.4	8,600	9,500	6.4
Tandem	129	243	3.0	748	1,401	1.0
Perkin Elmer	186	225	2.8	2,021	1,835	1.2
Sperry Univac	84	133	1.6	1,117	1,562	1.0
SEL	89	122	1.5	410	700	0.5
Modcomp	81	87	1.0	525	776	0.5
Harris	76	84	1.0	518	402	0.3
GAI	155	82	1.0	4,573	2,528	1.7
CAI	81	72	0.9	6,464	4,245	2.8
Others	149	105	1.3	5,222	7,458	5.0
TOTAL	6,430	8,116	100.0%	156,000	149,000	100.0%

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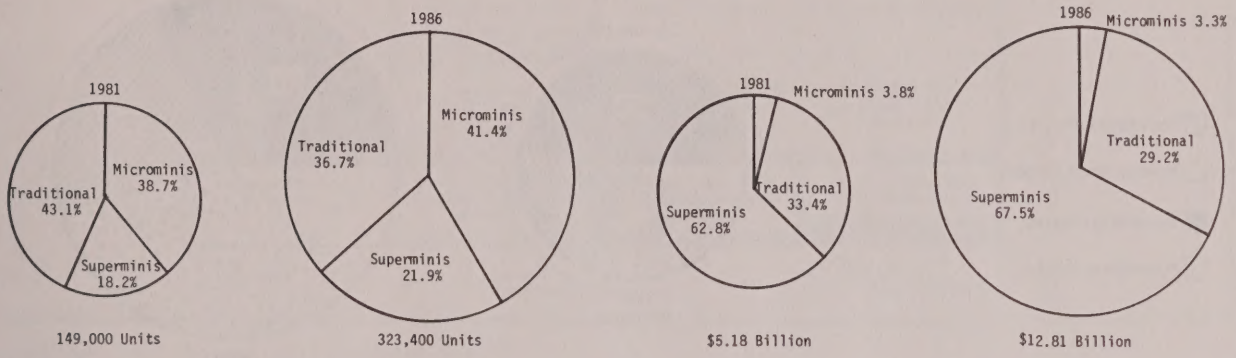
WORLDWIDE MINI PROCESSOR SHIPMENTS, U.S.-BASED MANUFACTURERS, 1981-1986
(Copyright 1982 -- International Data Corporation)



The figures above do not include add-on peripherals, and thus will not add to the total of mini shipments on the red page. The numbers show that the share of traditional minis will fall for both value and units, but the dollars will decline less, thanks to rising average system values. Average system values for superminis are also rising, while those for microminis are falling.

Processing terminals and DDP

Though processing terminals such as the IBM 8100 and the Datapoint 1800 are not included in IDC's processor forecasts, they are steadily becoming a major marketplace. 1981 shipments of clustered and single station processing terminals were valued at $1.4 billion and will grow at 22% through 1986 when they will reach $3.8 billion. Clustered systems continue to grow faster than single station models accounting for 78% of the units in 1981 and 81% in 1986.

Despite the fact that its 8100 should have been in a peak shipment year, IBM watched its 1981 market share drop from third to fourth place. Datapoint and Four Phase held their first and second positions, while Univac edged into third. Mohawk, Raytheon, Nixdorf, Pertec, Northern Telecom, and Harris round out the top ten.

The debate between the 8100 and the 4300 continues unresolved, although it seems that IBM is increasingly looking towards the 4300 as its low-end DDP node. Despite new, more powerful 8100s, acceptance is being retarded by the lack of available application software for the 8100 DPPX and DPCX operating systems. The 8100 has also been criticized on price/performance grounds and for lack of any kind of upgrade path. However, IDC user surveys indicate that many users are happy with their 8100s, and the machine does have some elegant communications features designed with SNA in mind.

As is the case with minicomputers and small business systems, multi-functionality is increasingly being expected of clustered processing systems. Word processing and electronic mail are becoming standard, and most major vendors have recognized the need to pay homage to the buzzword of office automation. Four-Phase, acquired in 1981 by Motorola, has been aggressive in this area using the IBM-compatible mainframes that came with its acquisition of Two Pi.

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MARKET SEGMENTATION OF WORLDWIDE VALUE-ADDED SERVICES MARKET,
U.S.-BASED VENDORS, 1981-1986
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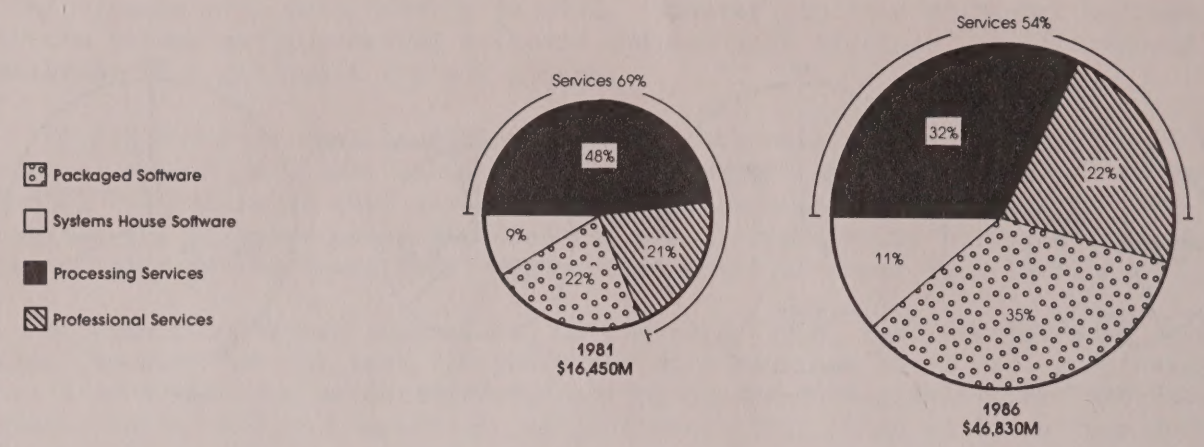

Software on the rise

Software continues to be the star of the value-added supplier portion of the marketplace, increasing its worldwide share from today's 22% to 35% by 1986. Revenues will grow at an impressive 36% through 1986. The picture is bright in all corners. New interest in operating systems, compilers, languages, communications, data base management, and larger addressing will be enough to keep system software stong at 31% per year, while the proliferation of desktop computers will give a boost to the already strong demand for packaged software.

Not surprisingly, software follows hardware and thus desktops are the fastest growing market for software, followed by minis/SBCs, and mainframes. But because of its market predominance, mainframe software accounted for 74% of 1981 software revenues, and the still nascent desktop market for just 4% of the 1981 total. Among some of the other driving forces:

- Application backlog. DP departments can't keep up with user demand, fueling packaged data base, desktop, and application software sales.
- Economics. The efficiency of internal development vs. outside purchase continues to tilt towards the latter.
- Joint marketing. Many major hardware vendors, including IBM and DEC, made formal efforts to improve their relations with independent software vendors. IBM's work with MSA typifies the giant's new attitude.
- Transportable systems. CP/M and UCSD-P for desktops and Unix for minis promise to improve software transportability, improving packaged software developmental economics.
- International successes. U.S. software is doing increasingly well in international markets.
- New markets. Graphics, artificial intelligence, CAD/CAM, sophisticated modeling and decision support software are expanding the value-added territory.

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PROCESSING SERVICES MATRIX, BY ACCESS METHOD AND APPLICATION
(Copyright 1982 -- International Data Corporation)

	Batch	Remote Batch	Interactive
Transaction Processing (Solutions)	Payroll Processing Accounts Receivable	Inventory Control Claims Processing	Invoicing Electronic Funds Transfer
Data Base Inquiry (Retrieval)	Business Credit Checking	Multiple Listing Services Library Cataloging Services	Stock Quotations Credit Card Authorization
Problem Solving (Tools)	Raw Computer Time Scientific/Engineering Applications	Raw Computer Time Scientific/Engineering Applications	Raw Computer Time Financial Modeling

Batch
Remote Automated Transaction
Remote Problem Solving

Services, an inevitable slow down?

The effects of the recession made 1981 a rather poor year for some, if not all of the processing services industry. Feast or famine tended to track the general economy with companies that serve automobile or real estate suffering, and those in insurance or banking holding up rather well. Hardest hit were the timesharing companies whose growth slowed from 24% in 1980 to 16% in 1981, as companies such as Tymshare experienced unaccustomed growing pains and lost some of their Wall Street luster.

SEGMENTATION WORLDWIDE PROCESSING SERVICES MARKET,
U.S.-BASED VENDORS 1981-1986
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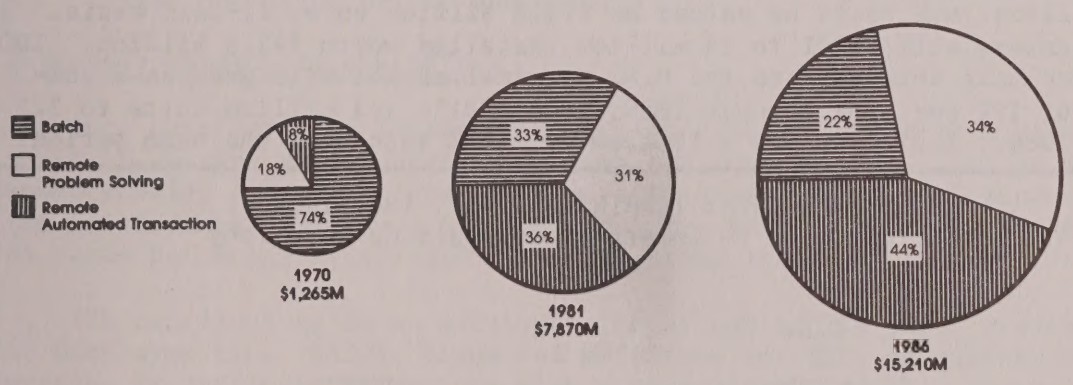

Today's technology is working against the shared hardware principle that has driven the processing services industry since its inception. Consequently, IDC believes that processing services will steadily decline as a percentage of the value-added pie, losing some three percent a year until 1986 when they will account for only about one-third of all value-added revenues.

Overall, the processing services industry is expected to grow at only 14% per year, from $7.9 billion today to $14.9 billion in 1986. Remote problem solving and remote autotransaction services will grow at 16% and 19% per year and batch will plug along at 5% per year. By 1986, autotransaction will control 44% of the market, followed by problem solving (34%), and batch (22%).

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If processing services vendors are to rekindle the growth of the past, they will have to pioneer new areas such as specialized data bases that feed into decision support systems, or complex inter- and intra-company transaction processing networks. In other words, they will have to emphasize shared software and data, staying one step ahead of what the user can do for himself. Among some of the key questions:

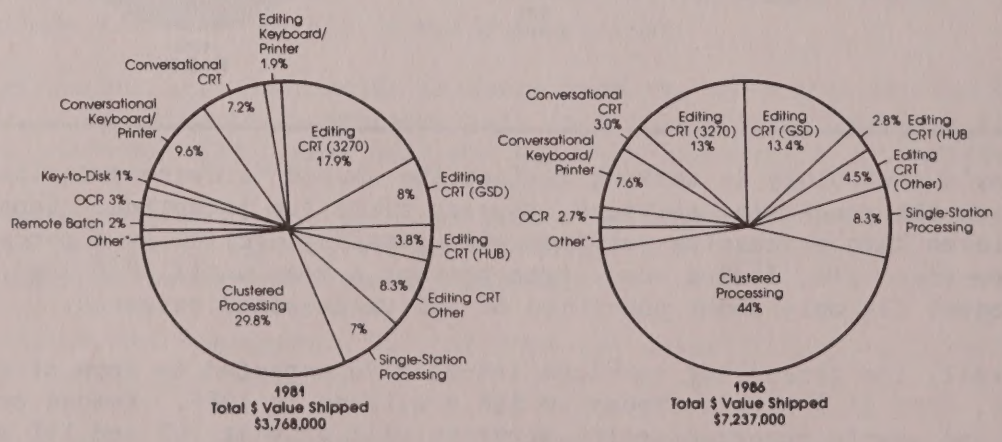
- Since processing services firms sell primarily to end users, how will the advent of personal computers and new DP/end-user cooperation affect processing services demand?
- What is the future of timesharing now that increasingly powerful microcomputers and 32-bit minis are becoming relatively inexpensive?
- Will the emergence of user-friendly systems eliminate the need for the handholding which processing services firms usually provide?
- What will be the impact of IBM's and AT&T's entrance into the market? How about the banks and accounting firms?

Terminals

A good way to put the growth of the information processing industry into human terms, is to look at the number and development of keyboards. Not only does keyboard analysis show that information technology reaches vast numbers of workers, but it demonstrates many of the key trends of the day -- distributed intelligence, ergonomics, user-friendly systems, and end-user demand.

The current U.S. installed base of general-purpose data entry terminals is over 5.4 million, and would be valued at $16.8 billion on an if-sold basis. By 1986, the numbers will swell to 15 million installed worth $42.6 billion. IDC projects that unit shipments to the U.S. terminal market will grow at a compound rate of 19% per year through 1986, from 1981's 1.3 million units to 3.1 million in 1986. Dollar values will grow at a 14% rate over the same period.

U.S. DATA ENTRY TERMINAL MARKET, 1981-1986
(Copyright 1982 -- International Data Corporation)



Note: "HUB" stands for Honeywell, Univac, Burroughs.

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Despite numerous efforts involving flat screens, portability, and improved man/machine interfaces, IDC believes that through the 1986 timeframe, today's CRT technology will remain dominant. Prices will come down a bit, and intelligence, screen quality, and ergonomic features will be improved, but the basic tube technology will be with us for some time. Among some of the factors affecting the terminal market:

- Personal computing and word processing features are becoming necessary in many environments, encouraging the already strong movement toward increased terminal intelligence. DEC and Univac have CP/M on their terminals; IBM is putting 3270 capabilities into its Personal Computer.

- IBM continues to watch its market share shrink. 3270-compatible vendors have undercut the giant's prices, and no follow-on products have emerged. Nonetheless, because of strong processor shipments and stepped up discounting, IBM should be able to hold much of its current position, and IDC believes that IBM will maintain about 25% of the U.S. installed base for the foreseeable future.

- DEC continues to gain share, shipping 40% as much as IBM in 1981.

- Now that the wraps are off AT&T, EDP/IR expects that Teletype -- or another terminal provider -- will become a much more aggressive competitor. If American Bell's Net 1 (now called Net/1000) becomes a success, it will give Ma Bell a captive terminal market.

- The lines between "dumb" and intelligent terminals are becoming less certain as vendors offer more features on low-end products to help fight declining prices and margins.

Everybody heading to the office

Once considered an interesting niche in the DP marketplace, the office has steadily emerged as the battleground of the future. 1981 saw the major mini vendors bring out their first serious office automation (OA) products, while the mainframers hemmed and hawed, paying lip service to the need to integrate OA tasks but doing relatively little to bring it about.

IBM continues to do an excellent job of making its plans unclear. A choice of Displaywriters, 5520s, 8100s and mainframe software is available, but integration is difficult and no one plan approaches the ideal. Among the other mainframers, only Burroughs and Honeywell have even taken the first step beyond word processing. Burroughs' Ofis 1 system has some innovative retrieval capabilities, and Honeywell has integrated DP/WP functions for its DPS 6 line.

Because the market is essentially one of software, the traditional office equipment market only tells part of the story. In fact, looking at the growth rates for equipment such as PBXs, facsimile machines, copiers, electronic typewriters, and word processors, one might wonder what all the fuss is about.

Only electronic typewriters and word processors are growing at more than 15% per year and the huge copier market is practically flat. Overall, the market for office automation hardware will grow at 10.2% through 1986, with 1981 shipments of $6.9 billion rising to $11.2 billion by 1986.

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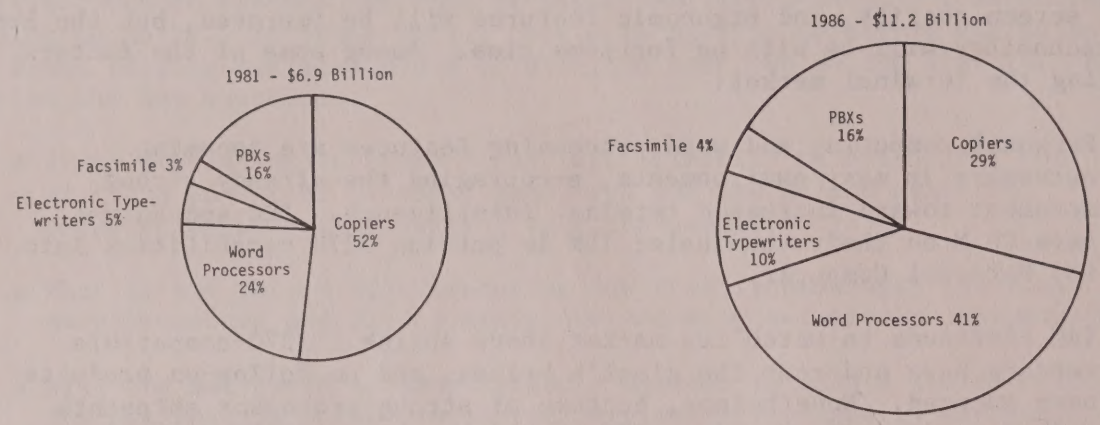
U.S. OFFICE AUTOMATION EQUIPMENT MARKET, 1981-1986
(Copyright 1981 -- International Data Corporation)



In the U.S. office market, IDC counts shipments of non-U.S.-based vendors.

The troubles in the copier market stand out. Because of declining prices in the low-end and saturation at higher levels, IDC expects that annual copier shipment revenues will change little from 1981's $3.5 billion. In light of this, no one should be surprised at Xerox's eagerness to get a piece of the office automation dollar, especially since the Japanese do not seem satisfied with their dominance of the low-end.

Despite annual growth rates of only 10.4% for the next five years, the PBX market is being actively pursued. (PBX dollar values are expressed in "wholesale prices," not including installation costs which could easily double overall revenues.) Independent suppliers such as Mitel and Rolm have had some success in loosening Ma Bell's once iron-clad grip on the marketplace. Additionally, because digital PBXs may have a role in both local area networks and as a data gateway to the outside world, vendors are paying new attention to an otherwise mature market. Even IBM is looking at the market again, as evidenced by its recent cooperation with Mitel.

Though the equipment numbers lack punch, the office remains a key market. As desktops and minis are increasingly used for office functions, the traditional office hardware categories will account for smaller and smaller segments of the office automation market. And as office features begin to be expected by end-users, smooth office software becomes vital to many DP sales.

NOTES TO CENSUS AND FORECASTS

• Inflation -- The value of computer system shipments shown in the Review and Forecast pages (in red) represents the if-sold price of equipment at the time of sale. IDC expects inflation to continue at about 7% per year.

• Value -- The value of shipments and installed base includes peripheral sales based on IDC's Average System Values, shown in the Census sections.

• Installed base -- The "Number in Use" column accounts for retirements. In the minicomputer summary, this column also accounts for "transshipments," i.e., those computers which are originally shipped to a U.S. location, but are eventually installed outside the U.S.

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COMPUTER MARKET SUMMARY
(U.S.-Based Manufacturers)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1976	100,540	407,530	$13,332	$ 76.7
1977	164,370	547,360	16,315	89.4
1978	314,230	841,640	20,109	105.2
1979	459,080	1,265,320	23,149	121.3
1980	682,330	1,911,150	26,184	140.3
1981	1,040,140	2,907,330	29,391	154.0
1982	1,755,325	4,608,855	33,887	173.5
1983	2,791,395	7,344,950	40,729	199.4
1984	3,942,275	11,224,515	48,499	230.9
1985	4,918,320	16,072,885	55,366	270.2
1986	5,871,310	21,863,535	62,371	313.2
		UNITED STATES		
1976	64,740	261,580	$ 7,098	$ 43.4
1977	113,680	356,420	9,101	50.6
1978	226,230	566,150	10,997	59.1
1979	298,010	836,760	12,528	67.3
1980	460,350	1,269,610	14,932	78.3
1981	710,070	1,952,520	17,095	88.5
1982	1,258,135	3,178,555	20,109	100.0
1983	2,083,945	5,226,100	25,015	116.5
1984	2,965,335	8,150,625	30,255	136.5
1985	3,668,260	11,773,835	34,787	162.0
1986	4,324,410	16,046,785	39,113	189.8
		INTERNATIONAL		
1976	35,800	145,950	$ 6,234	$ 33.3
1977	50,690	190,940	7,214	38.8
1978	88,000	275,490	9,112	46.1
1979	161,070	428,560	10,621	54.0
1980	221,980	641,540	11,252	62.0
1981	330,070	954,810	12,296	65.5
1982	497,190	1,430,300	13,778	73.5
1983	707,450	2,118,850	15,714	82.9
1984	976,940	3,073,890	18,244	94.4
1985	1,250,060	4,299,050	20,579	108.2
1986	1,546,900	5,816,750	23,258	123.4

This is the total of all general-purpose computers, minicomputers, small business computers, desktop computers, and "other" systems such as IBM's S/7. Minis used in SBCs are subtracted to avoid double counting.

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GENERAL-PURPOSE COMPUTER MARKET
(U.S.-Based Manufacturers)

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1976	14,300	111,200	10,830	68.5
1977	17,800	111,500	12,500	77.7
1978	10,500	113,000	14,740	88.6
1979	10,600	105,900	15,790	97.9
1980	20,100	110,700	16,650	108.1
1981	21,700	110,200	17,360	110.6
1982	20,900	113,600	18,460	115.5
1983	22,400	119,400	20,300	122.1
1984	23,000	126,300	22,100	128.6
1985	22,700	134,100	23,300	137.5
1986	22,400	140,700	24,700	144.8
		UNITED STATES		
1976	6,700	59,600	5,530	37.9
1977	8,900	58,200	6,600	42.9
1978	4,300	58,000	7,590	48.4
1979	5,000	53,500	7,930	52.5
1980	9,900	55,000	8,840	58.0
1981	10,700	55,600	9,640	61.4
1982	10,600	56,400	10,300	63.7
1983	11,300	59,000	11,400	67.3
1984	11,700	62,300	12,400	70.4
1985	11,500	65,900	13,000	75.1
1986	11,300	68,900	13,700	78.7
		INTERNATIONAL		
1976	7,600	51,600	5,300	30.6
1977	8,900	53,300	5,900	34.8
1978	6,500	55,000	7,150	40.2
1979	5,600	52,400	7,860	45.4
1980	10,200	55,700	7,810	50.1
1981	11,000	54,600	7,720	49.2
1982	10,300	57,200	8,160	51.8
1983	11,100	60,400	8,900	54.8
1984	11,300	64,000	9,700	58.2
1985	11,200	68,200	10,300	62.4
1986	11,100	71,800	11,000	66.1

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MINICOMPUTER MARKET -- U.S.-BASED MANUFACTURERS[a]

	Number Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1976	58,600	235,500	1,550	5.2
1977	83,300	312,700	2,410	7.4
1978	103,100	407,600	3,170	10.4
1979	123,800	519,300	4,020	14.1
1980	156,000	660,000	5,050	18.8
1981	149,000	790,900	6,180	24.5
1982	151,500	920,600	7,175	31.2
1983	171,800	1,064,300	8,635	39.2
1984	210,300	1,241,200	10,590	49.0
1985	261,600	1,463,500	12,850	60.9
1986	323,400	1,741,500	15,355	75.2
		UNITED STATES		
1976	42,200	162,500	995	3.4
1977	60,800	215,500	1,570	4.8
1978	71,700	277,300	2,005	6.6
1979	82,000	346,000	2,555	8.8
1980	94,700	426,200	3,240	11.8
1981	88,800	499,500	3,830	15.2
1982	89,400	571,700	4,375	19.2
1983	101,400	651,200	5,265	24.0
1984	122,000	747,600	6,355	29.8
1985	151,700	869,600	7,710	36.8
1986	184,300	1,019,900	9,060	45.1
		INTERNATIONAL		
1976	16,400	73,000	555	1.8
1977	22,500	97,200	840	2.6
1978	31,400	130,300	1,165	3.8
1979	41,800	173,300	1,465	5.3
1980	61,300	233,800	1,810	7.0
1981	60,200	291,400	2,350	9.3
1982	62,100	348,900	2,800	12.0
1983	70,400	413,100	3,370	15.2
1984	88,300	493,600	4,235	19.2
1985	109,900	593,900	5,140	24.1
1986	139,100	721,600	6,295	30.1

[a]International Manufacturers with U.S.-based sales offices are counted in the U.S. totals, but not international.

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GENERAL PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC but are estimates nevertheless. General-Purpose computers -- as characterized by IBM's System/3, System/38, 370, 4300, 303X, and 3081, and competitors -- are designed for use in a wide variety of applications. They are character or byte oriented and programmed in higher level languages. Many of the General-Purpose computer manufacturers also market smaller systems, also general-purpose in design, which are included in the Small Business Computer and Minicomputer censuses.

Instead of being defined by shifting average purchase or rental values, size classes are based on IBM products and other manufacturers' models that compete with them, e.g., a computer in size class 7 would compete with an IBM 3081. Average purchase and monthly rental values are based on system price including peripherals except for plug-compatible vendors Amdahl, Cambex, Control Data Corporation-Omega, IPL, Magnuson, and National Advanced Systems, where only CPU value is counted. An "X" in the last column means none will be shipped from the original manufacturer, and an "*" means none will be shipped until after 1982.

GENERAL-PURPOSE CENSUS AS OF JANUARY 1, 1982

Name of Manufacturer	Computer Model	Size Class	Average Purchase Price ($000)	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Amdahl	470V/5 II	6	2,240	09/77	41	33	74	X
	470V/6 II	7	3,330	06/75	130	52	182	X
	470V/7, A, B	7	2,515	09/78	126	98	224	40
	470V/7C	6	1,100	02/81	27	16	43	36
	470V/8	7	2,850	09/79	76	51	127	55
	580/5860	7	3,950	08/82	0	0	0	20
	580/5870	7	5,750	3Q/83	0	0	0	*
	580/5880	7	7,100	2Q/83	0	0	0	*
	TOTAL				400	250	650	151
Burroughs	2/3/500	3	315	11/61	160	86	246	X
	1710	2	132	08/72	295	321	616	X
	1720	2	355	02/73	217	219	436	X
	1815/25/30	3	115	05/77	270	530	800	20
	1855/60/70/85	2	243	05/77	1,660	660	2,320	500
	1905	3	103	04/80	170	40	210	230
	1955/85	2	189	04/80	805	320	1,125	600
	2500	3	499	02/67	8	5	13	X
	2700	4	530	08/72	120	77	197	X
	2800	4	411	12/76	245	130	375	X
	2900	4	458	07/80	317	155	472	200
	3500	4	910	05/67	130	117	247	X
	3700	4	1,230	11/72	184	186	370	X
	3800	4	629	04/77	270	77	347	10
	3900	4	650	04/81	55	5	60	160
	45/4700	5	1,561	10/71	186	80	266	X
	4800	5	1,269	09/76	272	95	367	X
	55/5700	5	1,680	03/63	18	9	27	X
	5900	5	500	01/81	90	10	100	150
	65/6700	6	3,168	11/69	104	80	184	X
	6800	5	1,649	06/77	310	125	435	20
	6900	5	2,140	11/80	113	38	151	150
	7700	7	6,421	08/73	45	27	72	X
	7800	7	4,820	11/78	58	22	80	10
	TOTAL				6,102	3,414	9,516	2,050
Cambex	1636	4	130	10/81	1	0	1	8
	1638/40	4	120	01/79	12	7	19	3
	1641	4	210	10/80	3	10	13	5
	1651	5	285	1Q/82	0	0	0	5
	TOTAL				16	17	33	21
Control Data Corp.	Omega 480-1	4	376	06/77	71	3	74	X
	Omega 480-2	5	392	08/78	63	4	67	X
	Omega 480-3	5	425	01/80	55	3	58	X
	Subtotal				189	10	199	0
	Cyber 170-720	5	1,360	05/79	70	85	155	45
	Cyber 170-730	6	1,940	06/79	41	20	61	15
	Cyber 170-740	6	2,880	04/80	7	0	7	20
	Cyber 170-750	6	4,239	08/79	19	20	39	15
	Cyber 170-760	7	5,290	04/79	28	4	32	20
	Cyber 71	4	959	07/76	2	5	7	X
	Cyber 171	4	1,092	08/77	13	45	58	X
	Cyber 72	5	1,832	10/71	7	21	28	X
	Cyber 172	6	1,947	07/75	21	46	67	X
	Cyber 73	6	2,072	03/72	20	30	50	X
	Cyber 173	6	3,173	09/75	11	24	35	X
	Cyber 74	7	4,827	03/72	22	13	35	X
	Cyber 174	6	4,055	09/75	13	16	29	X
	Cyber 175	7	5,776	08/75	20	28	48	X
	Cyber 76	7	7,912	03/72	6	8	14	X
	Cyber 176	7	7,140	01/78	13	3	16	3
	Cyber 203	7	9,520	11/80	4	0	4	2
	Cyber 205	7	10,510	01/81	3	1	4	7
	Cyber 855	6	1,935	4Q/82	0	0	0	10
	Cyber 865	7	2,465	2Q/83	0	0	0	*
	Cyber 875	7	3,230	4Q/82	0	0	0	*
	Subtotal				320	369	689	137
	G-20	4	830	04/61	3	0	3	X
	1604	6	1,751	01/60	6	0	6	X
	31/3150	4	419	12/64	22	11	33	X
	3170	5	971	12/70	11	4	15	X
	3200	4	625	05/64	16	10	26	X
	3300	5	1,491	09/65	69	23	92	X
	3400	5	1,020	11/64	2	0	2	X
	3500	5	1,342	01/69	25	12	37	X
	3600	6	2,107	06/63	6	5	11	X
	3800	6	2,568	12/65	12	1	15	X
	6200	6	1,849	11/70	-	-	-	X
	6400	6	2,722	05/66	30	10	40	X
	6500	6	3,698	12/67	14	11	25	X
	6600	7	4,988	08/64	40	14	54	X
	6700	7	6,066	07/70	2	-	2	X
	7600	7	8,194	01/69	22	6	28	X
	Star 100	7	12,040	12/74	-	-	-	X
	Subtotal				280	107	389	0
	TOTAL				789	486	1,277	137

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GENERAL-PURPOSE COMPUTER CENSUS - (continued)

Name of Manufacturer	Computer Model	Size Class	Average Purchase Price ($000)	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Cray	1A	7	8,560	04/76	9	7	16	
	1S	7	7,330	11/80	14	2	16	15
	TOTAL				23	9	32	15
Denelcor	HEP	7	2,225	02/82	0	0	0	7
Digital Equipment Corporation	2020	3	295	07/78	195	170	365	40
	2040/50	4	700	06/76	107	65	172	5
	2060	5	960	07/79	181	95	276	70
	PDP-6	4	400	10/64	1	1	2	X
	1040/50	4	694	10/67	78	35	113	X
	1060/70	5	880	06/72	93	60	153	X
	1080/90	6	1,320	06/75	225	115	340	40
	TOTAL				880	541	1,421	155
HIS	DPS 8/20	4	515	04/80	45	19	64	60
	DPS 8/44	4	810	01/80	49	40	89	50
	DPS 8/52	5	1,790	11/80	25	16	41	70
	DPS 8/62	5	2,200	12/81	3	0	3	50
	DPS 8/70	6	3,480	05/80	63	45	108	80
	Subtotal				185	120	305	310
	H 61/40	2	101	06/76	-	1,965	1,965	120
	H-61/58	2	104	06/74	87	692	779	X
	H-61/60	2	154	06/74	43	2,311	2,354	50
	H-Level 62	3	242	10/74	900	2,310	3,210	40
	DPS 4	3	80	07/80	-	1,953	1,953	1,500
	64/300	4	378	04/79	115	864	979	500
	H Level 64	4	549	10/74	260	1,002	1,262	X
	H-66/05/07	4	825	10/76	80	137	217	X
	H-66/10/17	5	1,339	06/75	50	109	159	X
	H-66/20/27	5	1,945	11/74	90	150	240	X
	H-66/40/60	6	3,690	10/74	130	167	297	2
	H-66/440/520	5	840	12/79	100	45	145	15
	H-66 DPS, BC	6	3,360	07/78	120	194	314	10
	H-66/80	7	5,672	10/74	20	57	77	X
	H-68/80	7	4,814	10/74	25	2	27	X
	H-68/DPS	7	5,360	09/78	31	12	43	16
	Comshare/Xerox	5	612	06/79	18	-	18	10
	Subtotal				2,069	11,970	14,039	2,263
	G-50	2	82	08/70	70	1,010	1,080	X
	G-100	3	215	04/66	56	611	667	X
	G-200	4	425	04/61	48	11	59	X
	G-400	4	690	05/64	83	91	174	X
	G-600	6	3,425	04/65	20	11	31	X
	G-6023/25	5	1,510	11/73	16	16	32	X
	G-6030/40	5	1,900	06/71	28	78	106	X
	G-6050/60	6	3,315	07/71	75	50	125	X
	G-6070/80	6	4,980	07/71	25	29	54	X
	G-6180	7	4,830	02/74	3	-	3	X
	Gamma-10	2	108	07/64	-	291	291	X
	Gamma-30	4	437	02/62	-	22	22	X
	Subtotal				424	2,220	2,644	0
	H 105/115	3	280	03/70	70	91	161	X
	H 110/120/200	3	297	01/66	140	80	220	X
	H-125	4	369	12/67	6	43	49	X
	H-2020/30	3	198	01/73	209	58	267	X
	H-1015/2015	4	818	02/71	22	16	38	X
	H-1200	4	629	02/66	112	28	140	X
	H-2040	4	599	04/72	91	48	139	X
	H-2050/60	4	941	04/72	93	61	154	X
	H-2200	4	862	01/66	47	13	60	X
	H-2070	5	1,681	05/72	24	2	26	X
	H-3200	5	1,302	02/70	44	21	65	X
	H-4200	5	1,984	09/68	6	1	7	X
	H-8200	6	3,075	02/69	12	6	18	X
	H-4/1400	4	573	12/61	6	5	11	X
	H-8/1800	5	1,500	12/60	5	2	7	X
	Subtotal				887	475	1,362	0
	TOTAL				3,565	14,785	18,350	2,573
IBM	System/38-3	2	140	07/80	630	570	1,200	
	System/38-4	3	145	08/81	65	-	65	
	System/38-5	3	290	07/80	2,795	1,890	4,685	2,400
	System/38-7	4	380	07/82	0	0	0	
	Subtotal				3,490	2,460	5,950	2,400
	System/3-4	2	62	06/76	100	30	130	X
	System/3-6	2	79	12/70	365	130	495	X
	System/3-8	2	100	06/75	885	1,100	1,985	X
	System/3-10	2	118	01/70	3,335	1,110	4,445	X
	System/3-12	3	173	03/76	1,675	1,475	3,150	X
	System/3-15	3	338	03/74	2,855	1,505	4,360	X
	Subtotal				9,215	5,350	14,565	0
	4321	3		03/82	0	0	0	
	4331-1	3	335	04/79	3,950	2,830	6,780	3,500
	4331-11	4	370	03/82	0	0	0	
	4331-2	4	555	08/80	795	550	1,345	
	4341-10	4	785	03/82	0	0	0	
	4341-1	4	860	10/79	4,420	4,275	8,695	3,600
	4341-11	4	895	03/82	0	0	0	
	4341-2	5	995	03/81	475	350	825	900
	Subtotal				9,640	8,005	17,645	8,000
	3031	6	2,390	03/78	1,000	1,180	2,180	X
	3032	6	3,972	03/78	290	470	760	X
	3033S	6	3,270	01/81	65	20	85	60
	3033N	7	3,680	01/80	220	280	500	
	3033UAM	7	6,880	03/78	950	610	1,560	100
	Subtotal				2,525	2,560	5,085	160

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GENERAL-PURPOSE COMPUTER CENSUS - (continued)

Name of Manufacturer	Computer Model	Size Class	Average Purchase Price ($000)	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
IBM (Continued)	3081D	7	7,100	10/81	120	80	200	644
	3081K	7	7,700	06/82	0	0	0	
	Subtotal				120	80	200	644
	370/115	3	478	04/74	275	1,010	1,285	X
	370/125	4	652	06/73	350	805	1,155	X
	370/135	4	1,000	05/72	455	545	1,000	X
	370/138	4	943	11/76	1,160	1,640	2,800	X
	370/145	5	1,871	07/71	560	510	1,070	X
	370/148	5	1,558	03/77	1,065	1,100	2,165	X
	370/155	6	3,368	02/71	270	80	350	X
	370/158	6	4,848	05/73	1,330	880	2,210	X
	370/165	7	6,344	06/71	55	11	66	X
	370/168	7	9,320	07/73	610	250	860	X
	370/195	7	12,800	03/71	9	3	12	X
	Subtotal				6,139	6,834	12,973	0
	360/20	3	126	12/65	440	220	660	X
	360/22	3	141	07/71	24	30	54	X
	360/25	3	391	10/68	27	95	122	X
	360/30	4	528	06/65	605	195	800	X
	360/44	4	881	07/66	33	16	49	X
	360/40	4	895	06/65	550	195	745	X
	360/50	5	1,551	08/65	235	95	330	X
	360/65	6	3,250	11/65	220	40	260	X
	360/67,75,85	7	6,016	01/66	25	8	33	X
	360/9X	7	9,146	11/67	4	2	6	X
	Subtotal				2,163	896	3,059	0
	1130	2	120	02/66	715	400	1,115	X
	1401	3	178	09/60	310	45	355	X
	1401G-H	2	106	05/64	6	1	7	X
	1410	4	800	11/61	7	1	8	X
	1440	3	227	04/63	17	10	27	X
	1460	4	460	10/63	5	1	6	X
	1620	3	129	09/60	32	18	50	X
	7010	5	1,200	10/63	4	1	5	X
	7030	7	-	05/61	-	-	-	X
	7040/44	5	1,439	06/63	4	1	5	X
	7070/74	5	1,299	03/60	27	-	27	X
	7080	6	2,800	08/61	17	-	17	X
	7090/94	6	3,350	08/60	8	2	10	X
	Subtotal				1,152	480	1,632	0
	TOTAL				34,444	26,665	61,109	11,204
IPL	4436	4	190	11/80	23	11	34	15
	4443	4	240	03/80	50	63	113	40
	4445	4	270	4Q/82	*	*	*	7
	4446	4	310	12/81	7	1	8	35
	TOTAL				80	75	155	97
Magnuson	M80/3	4	210	01/79	18	1	19	X
	M80/4	5	313	12/78	41	4	45	X
	M80/30	4	94	08/81	18	2	20	20
	M80/30E	4	112	12/81	1	0	1	20
	M80/31	4	150	06/80	55	6	61	10
	M80/32	4	225	06/80	103	11	114	10
	M80/41	4	196	02/82	*	*	*	25
	M80/42	4	324	03/81	53	6	59	15
	M80/43	5	384	03/81	48	5	53	25
	TOTAL				337	35	372	180
National Advanced Systems	AS/3	4	610	11/78	28	33	61	X
	AS/4	5	950	06/77	23	11	34	X
	AS/5	6	1,485	03/77	122	89	211	X
	AS/7020/309	5	800	01/79	-	10	10	X
	AS/7031	6	1,365	12/78	43	29	72	X
	AS/6	6	2,385	12/78	48	39	87	X
	AS/3000	4	470	01/80	25	7	32	5
	AS/5000	5	575	02/80	70	35	105	40
	AS/6130	5	1,095	4Q/82	0	0	0	5
	AS/6150	5	1,160	1Q/83	0	0	0	*
	AS/7000	6	1,640	04/80	35	33	68	35
	AS/9000	7	4,335	12/80	11	11	22	32
	AS/9060	7	3,500	4Q/82	0	0	0	5
	AS/9080	7	5,200	4Q/82	0	0	0	3
	TOTAL				405	297	702	125
NCR	8270	2	95	11/79	404	620	1,024	350
	8350	2	152	07/77	124	5	129	X
	8370	3	283	07/78	10	-	10	X
	8410	2	169	02/79	240	290	530	150
	8430	3	250	06/78	77	270	347	120
	8450	3	377	11/77	170	155	325	X
	8455	3	275	04/79	147	260	407	40
	8535II	3	220	04/82	0	0	0	120
	8545II	3	315	04/82	0	0	0	120
	8550	3	583	04/76	190	168	358	X
	8555	3	465	04/79	260	240	500	40
	8555II	3	400	04/82	0	0	0	190
	8560	4	726	11/77	44	26	70	X
	8565	4	570	04/79	90	151	241	30
	8565 II	4	440	04/82	0	0	0	70
	8570	4	905	05/76	90	86	176	X
	8575	4	695	04/79	95	68	163	20
	8580	5	1,614	12/78	5	10	15	X
	8585	5	1,390	08/79	28	49	77	5
	8650	6	2,200	11/81	0	2	2	12
	8670	6	3,000	05/82	0	0	0	8
	8575 II	5	514	05/82	0	0	0	20
	8585 II	5	549	05/82	0	0	0	40
	8595 II	5	696	05/82	0	0	0	20
	Subtotal				1,974	2,400	4,374	1,355

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GENERAL-PURPOSE COMPUTER CENSUS - (continued)

Name of Manufacturer	Computer Model	Size Class	Average Purchase Price ($000)	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
NCR (Continued)	Century 50	2	80	02/71	137	16	153	X
	Century 75	2	117	07/76	44	-	44	X
	Century 100	3	162	09/68	142	225	367	X
	Century 101	3	206	10/72	403	357	760	X
	Century 151	3	289	02/75	158	108	266	X
	Century 200	4	378	09/69	90	124	214	X
	Century 201	4	590	09/69	109	58	167	X
	Century 251	4	1,005	11/73	24	39	63	X
	Century 300	5	1,400	02/72	65	51	116	X
	315	3	169	05/62	4	20	24	X
	315-RMC	4	523	09/65	3	2	5	X
	Subtotal				1,179	1,000	2,179	0
	TOTAL				3,153	3,400	6,553	1,355
Singer	System 10	2	120	10/70	1,000	-	1,000	X
Sperry Univac	III	4	1,124	08/62	-	-	-	X
	SS 80/90	3	355	08/58	-	2	2	X
	418 I, II	4	450	06/63	29	30	59	X
	418 III	4	1,700	06/69	47	93	140	X
	491/492	5	1,150	12/61	2	3	5	X
	494	6	3,200	02/66	62	49	111	X
	1004	2	46	02/63	186	57	243	X
	1005	2	85	04/66	121	7	128	X
	1050	3	380	09/63	40	8	48	X
	Subtotal				487	249	736	0
	9200	2	98	06/67	550	327	877	X
	9300	3	212	09/67	450	273	723	X
	9400/80	4	530	05/69	137	300	437	X
	90/25	3	184	08/77	50	91	141	X
	90/30	3	392	02/75	820	1,337	2,157	20
	90/40	4	714	06/78	130	172	302	9
	90/60	4	1,109	01/74	120	147	267	X
	90/70/9700	5	1,275	08/72	5	23	28	X
	90/80	5	2,940	12/76	90	55	145	X
	System/80-3	2	140	12/80	265	430	695	600
	System/80-5	3	203	20/82	0	0	0	150
	Subtotal				2,617	3,155	5,772	779
	1106	6	1,920	12/69	35	125	160	X
	1107	6	2,525	10/62	1	3	4	X
	1108	7	3,745	09/65	153	57	210	X
	1110	7	6,250	06/72	20	50	70	X
	1100/10	5	1,955	04/76	83	165	248	X
	1100/20	5	2,650	04/75	6	28	34	X
	1100/40	6	4,470	07/75	39	41	80	X
	1100/60	5	1,720	01/80	220	475	695	509
	1100/80/81/82	6	5,254	03/77	160	155	315	10
	1100/83	7	8,325	07/78	15	20	35	5
	1100/84	7	10,040	11/78	25	20	45	X
	Subtotal				757	1,139	1,896	524
	301	4	295	10/60	6	-	6	X
	501	5	695	05/59	-	-	-	X
	3301	5	1,021	09/64	26	-	26	X
	Spectra 70/15	3	203	09/65	2	-	2	X
	Spectra 70/25	3	343	09/65	-	1	1	X
	Spectra 70/35	4	634	01/67	17	3	20	X
	Spectra 70/45	5	1,181	11/65	57	2	59	X
	Spectra 70/46	5	1,963	11/68	4	-	4	X
	Spectra 70/55	5	1,800	11/68	1	-	1	X
	Spectra 70/60	6	2,245	09/70	17	-	17	X
	Spectra 70/61	6	2,350	03/71	2	1	3	X
	Spectra 1600	3	180	01/69	17	-	17	X
	Spectra 70/2	4	620	07/71	3	-	3	X
	Spectra 70/3	4	1,040	10/71	6	-	6	X
	Spectra 70/6	6	1,680	10/71	18	-	18	X
	Spectra 70/7	6	2,140	10/71	12	2	14	X
	Subtotal				188	9	197	0
	TOTAL				4,049	4,552	8,601	1,303
Xerox	Sigma 5	4	585	08/67	102	10	112	X
	Sigma 6	4	1,041	11/70	22	13	35	X
	Sigma 7	5	1,169	12/66	52	7	59	X
	Sigma 8	4	928	09/71	1	1	2	X
	Sigma 9	6	2,440	11/71	71	27	98	X
	530	3	188	08/73	88	15	103	X
	550/560	4	634	11/74	23	3	26	X
	940	5	1,050	04/66	31	-	31	X
	9300	3	340	11/64	9	2	11	X
	Total				399	78	477	0
GRAND TOTAL					55,635	54,604	110,239	

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MINICOMPUTER CENSUS

IDC categorizes computers as "minicomputers" based primarily on the perceived marketplace for these products. By definition, minis are general-purpose in design, but are sold as tools as well as solutions; are available from makers in configurations ranging from board only to complete systems; are available to OEMs and are usually discounted in volume buys; are part of a family with low-end products generally in the $1,000-$25,000 price range; and have at least 4K RAM. Minicomputers range in size class from Microminis (M), which compete with high-end Microcomputers, to Traditional Minis (T), to Superminis (S), which frequently compete with small General-Purpose computers in interactive commercial applications. This census counts "Cumulative Number Shipped," making no attempt to account for retirements.

MINICOMPUTER CENSUS AS OF JANUARY 1, 1982

Name of Manufacturer	Computer Model	Bits Per Word	Size Class	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Able Computer	34 Magnum	16	T	21	14	10/81	10	0	10	50
	44 Magnum	16	S	27	16	07/81	20	0	20	100
						TOTAL	30	0	30	150
Ampex	8MS/86	16	T	7	6	06/78	1,700	1,300	3,000	NA
	Difference Series	16	T	14	19	12/80				NA
Artonix*	PC-12/7	12	T	20	45	09/71	135	40	175	X
Apollo Computer	DN400	16	S	31	35	03/81	64	16	80	NA
	DN420	16	S	33	40	03/81	16	4	20	NA
						TOTAL	80	20	100	
August Systems	Series 300	16	S	35	25	11/81	3	0	3	35
BTI Computer Systems	4000/15	16	T	30	35	01/76	341	8	349	X
	4000/25	16	T	42	49	01/76	251	12	263	X
	5000	16	S	30	39	09/78	3,400	110	3,510	1,300
	5000/ES	16	S	25	30	07/79	74	0	74	5
	8000	32	S	107	200	05/81	23	3	26	80
						TOTAL	4,089	133	4,222	1,385
Bytronix	Series 500	16	T	3	4	09/80	155	275	430	1,500
	Series 1000	16	T	5	5	12/77	180	550	730	
	Series 2000	16	T	8	8	12/78	75	115	190	X
	Series 3000	16	T	7	8	12/78	85	445	530	X
	Series 4000	16	T	7	5	03/81	100	300	400	500
	Series 5000	16	T	10	7	09/81	5	10	15	200
						TOTAL	600	1,695	2,295	2,200
Century Computer Corp.	C-200	8	T	5	7	02/71	150	0	150	X
Charles River Data	Universe 68/15	32	S	19	15	02/82	0	0	0	NA
	Universe 68/17	32	S	21	17	04/82	0	0	0	NA
	Universe 68/27	32	S	17	14	08/82	0	0	0	NA
	Universe 68/37	32	S	18	15	08/82	0	0	0	NA
	Universe 68/47	32	S	22	18	08/82	0	0	0	NA
	Universe 68/80	32	S	39	31	10/81	8	0	8	NA
						TOTAL	8	0	8	
Cincinnati Milacron	CIP/2000 Series	8	T	4	17	07/69	4,676	804	5,480	X
	CIP/4000 Series	10	T	4	17	12/76				X
Compiler Systems, Inc.*	CSI-16	16	T	11	20	11/70	80	10	90	X
	CSI-24	24	T	15	30	12/70	35	5	40	X
						TOTAL	115	15	130	
Computer Automation, Inc.	108, 208, 808	8	T	5	11	04/68	280	30	310	X
	116	16	T	8	16	08/70	200	50	250	X
	216	16	T	8	20	07/69	350	45	395	X
	816	16	T	10	15	12/68	40	5	45	X
	Alpha-8, Naked Mini-8	8	T	2	3	05/72	5,002	1,340	6,342	X
	Alpha-16, Naked Mini-16	16	T	3	8	10/71				X
	LSI 2/10, 2/20, 2/60	16	T, T, S	2	5	12/73	21,462	2,540	24,002	1,500
	LSI 2/40	16	T	8	18	04/80	66	62	128	150
	LSI 3/05	16	M	1	2	02/76	2,332	679	3,011	80
	LSI 4/10	16	M	1	2	06/77	4,032	2,052	6,084	2,100
	LSI 4/30	16	T	2	4	06/77	1,404	460	1,864	430
	LSI 4/90	16	S	4	9	06/77	711	315	1,026	350
	LSI 4/95	16	S	10	24	01/80	40	12	52	50
	Scout Naked Mini 4/04	16	M	0.6	2	01/80	267	222	489	140
						TOTAL	36,186	7,812	43,998	4,800
Computer Talk Inc.	CT-400	16	S	32	45	09/75	7	0	7	10
	CT-407	16	S	41	45	12/77	3	0	3	
						TOTAL	10	0	10	
Control Data Corp.	1700	16+2	S	37	160	03/66				X
	1700-SC	16+2	S	20	60	09/70				X
	System 17	16+2	T	14	39	02/74				X
	Cyber 18-10	16+2	T	14	40	--/76	2,060	1,415	3,475	
	Cyber 18-20	16+2	T	16	75	--/76				290
	Cyber 18-30	16+2	S	110	116	09/76				
	Cyber 18-5	16+2	T	14	35	--/77				
	Elbit-100	12	T	6	8	06/77	5	445	450	X
						TOTAL	2,065	1,860	3,925	
Data General Corp.	MP 100, 200	16	M	1	3	05/79	2,700	800	3,500	150
	Micro Nova	16	M	2	4	11/79	7,995	3,325	11,320	5,400
	Nova	16	T	6	12	02/69	670	330	1,000	X
	Nova 2 Series	16	T	3	10	10/73	7,280	2,720	10,000	300
	Nova 3/4	16	T	4	10	01/76	3,240	1,060	4,300	600
	Nova 3/12	16	T	5	18	01/76	10,570	4,830	15,400	1,700
	Nova 3/D	16	T	12	36	10/76	2,240	2,060	4,300	900
	Nova 4/C	16	T	3	12	03/79				
	Nova 4/S	16	T	3	16	03/79	9,000	6,000	15,000	8,200
	Nova 4/X	16	T	10	33	03/79				
	Nova 800/820	16	T	7	40	03/71	1,620	580	2,200	X
	Nova 830/840	16	S	16	44	07/73	520	280	800	X
	Nova 1200 Series	16	T	3	11	12/70	10,870	4,130	15,000	X
	Super Nova SC	16	T	9	27	04/70	140	60	200	X
	Eclipse S100, 130, 140	16	S	11	30	02/75	3,300	1,700	5,000	2,300
	Eclipse AP/130	16	S	30	50	09/78				
	Eclipse S200, 230	16	S	15	55	02/75	3,870	1,330	5,200	500
	Eclipse S/250	16	S	35	150	11/78	380	120	500	60
	Eclipse C/150	16	S	55	120	12/78	380	220	600	250
	Eclipse C/300, 330	16	S	24	150	02/75	800	200	1,000	30
	Eclipse C/350	16	S	130	180	11/78	600	200	800	230
	Eclipse M/600	16	S	164	215	05/78	285	95	380	15
	Eclipse MV/6000	32	S	120	200	02/82	0	0	0	NA
continued on next page	Eclipse MV/8000	32	S	153	300	10/80	190	110	300	300
						SUBTOTAL	66,650	30,150	96,800	

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Data General Corp. (continued)	DCC-112	12	T	3	12	08/70	900	500	1,400	X
	DCC-116	16	T	5	10	11/71	9,600	1,700	11,300	X
	DCC-416/616	16	T/S	3	7	09/75	180	20	200	X
	DCC-Model 5	16	T	3	6	02/76	90	10	100	X
						SUBTOTAL	10,770	2,230	13,000	
						TOTAL	77,420	32,380	109,800	
Datamate Computer Systems*	DM-16	16	T	17	26	11/69	12	0	12	X
	DM-70	16	T	9	15	12/70	25	0	25	X
	ECP-18	18	T	14	16	11/66	21	0	21	X
						TOTAL	58	0	58	
Datum, Inc.*	Enchancer E 1/16	16	T	8	15	03/76	15	3	18	X
Digiac Corp.*	3060		T	9	13	01/70	70	20	90	X
	3080	25	T	20	25	12/64	14	2	16	X
						TOTAL	84	22	106	
Digital Equipment Corp.	PDP-8/a,e,f,m	12	T	4	15	04/71	43,800	21,250	65,050	9,000
	PDP-8/i,l,s	12	T	8	27	05/65	5,765	3,685	9,450	X
	PDP-9, 9L	18	T	35	50	12/66	290	160	450	X
	PDP-11/03, LSI 11	16	M	2	3	06/75	102,480	66,100	168,580	48,000
	PDP-11/23, LSI 11/23	16	M	2	6	--/79				
	PDP-11/04,05,10,15,20	16	T	5	17	03/70	31,070	17,600	48,670	2,000
	PDP-11/34,35,40	16	T	9	40	01/73	27,165	20,490	47,655	7,000
	PDP-11/44	16	S	23	60	--/80	3,525	2,270	5,795	5,000
	PDP-11/45,50,55	16	S	24	91	04/72	4,550	1,460	6,010	X
	PDP-11/60	16	S	26	75	06/77	1,150	1,060	2,210	50
	PDP-11/70	16	S	60	175	07/75	7,480	3,320	10,800	1,000
	VAX-11/730	32	S	47	65	4Q/82	0	0	0	NA
	VAX-11/750	32	S	47	100	--/80	685	555	1,240	2,000
	VAX-11/780	32	S	128	305	05/78	2,390	1,660	4,050	2,200
	VAX-11/782	32	S	395	500	2Q/82	0	0	0	NA
	PDP-12	12	T	13	46	04/69	510	255	765	X
	PDP-15 XVM	18	T	15	82	02/70	550	320	870	X
						TOTAL	231,410	140,185	371,595	
Digital Microsystems	Hex-29	16	S	13	22	04/79	20	20	40	X
Digital Scientific Corp.	Meta-4/4000	16	S	29	90	04/70	140	15	155	X
	Meta-4/5010	16	S	21	40	10/78	5	0	5	X
	Meta-4/5020	16	T	25	90	04/78	48	0	48	3
	Meta-4/5030	16	S	53	140	06/79	15	1	16	8
						TOTAL	208	16	224	11
Electronic Associates, Inc.	Pacer-100	16	T	15	40	05/72	173	141	314	13
Foto-Mem, Inc.*	Contour-100	8	T	6	20	04/70	25	0	25	X
Formation	F/4000	32	S	91	134	08/81	21	5	26	17
Four-Phase Systems, Inc.[a]	Two Pi V/32	32	S	125	125	06/78	100	6	106	X
	System 311	32	S	160	265	02/81	95	5	100	150
	System 312	32	S	210	320	12/81	2	0	2	
						TOTAL	197	11	208	150
General Automation	GA-18/30	16	S	18	50	07/69	780	210	990	X
	SPC-12	8	T	4	16	01/68	3,250	860	4,110	X
	SPC-16	16	T	5	25	05/70	7,540	2,125	9,665	X
	16/110,220	16	M	1	3	12/75	7,845	2,010	9,855	2,100
	16/330,340	16	T	3	10	01/76	405	140	545	X
	16/440,460	16	S	12	30	07/75	2,070	625	2,695	40
	16/550	16	S	25	50	03/78	9	2	11	X
	230,240	16	M	7	9	05/80	573	225	798	450
	470,480	16	S	16	21	08/82	425	200	625	220
	900	16	S	7	30	04/82	0	0	0	NA
						TOTAL	22,897	6,397	29,294	
GRI Computer Corp.	909 Series	16	T	4	9	01/70	320	150	470	X
	99/30, 38	16	T	5	15	06/72	578	268	846	X
	99/10, 18	16	T	3	5	06/72	24	0	24	X
	99/40, 48	16	T	6	17	06/72	207	278	485	X
	99/50, 58	16	T	6	12	--/74	146	44	190	X
	99/52	16	T	8	17	--/76	7	3	10	X
	GRIP	16	T	30	30	11/78	25	0	25	X
						TOTAL	1,307	743	2,050	
GT&E*	IS/I	16	T	14	36	01/70	160	40	200	X
	IS/1000	16	T	6	10	06/72	4,000	75	4,075	X
						TOTAL	4,160	115	4,275	
Harris	6024/1	24	S	69	135	05/69	21	1	22	X
	6024/3	24	S	49	90	02/70	118	1	119	X
	Slash 4	24	S	24	110	08/73	243	18	261	3
	Slash 5	24	S	16	50	05/72	766	6	772	X
	Slash 6	24	S	20	70	12/76	323	10	333	3
	Slash 7	24	S	45	180	10/75	18	1	19	X
	Series 100	24	S	85	190	10/75	37	1	38	X
	Series 200	24	S	179	240	10/75	52	3	55	X
	Series 1X5	24	S	85	175	09/77	117	19	136	X
	Series 5X0	24	S	195	300	12/78	89	9	98	X
	H80	24	S	70	125	02/81	14	8	22	10
	H100	24	S	45	150	01/79	145	10	155	15
	H300	24/48	S	105	200	09/81	26	4	30	18
	H500	24/48	S	100	250	01/79	140	39	179	75
	H800	24/48	S	170	275	03/80	125	7	132	60
						TOTAL	2,234	137	2,371	184
Hewlett-Packard	2100A	16	T	7	15	06/71	7,900	3,400	11,300	X
	2100S	16	T	16	36	08/73	1,825	1,425	3,250	X
	2114/15/16	16	T	9	29	11/66	2,495	1,145	3,640	X
	1000-M (MX-M, K)	16	T	2	25	06/74	8,316	6,487	14,803	NA
	1000-E (MX-E)	16	T	14	40	01/77	9,263	9,237	18,500	NA
	1000-F	16	T	18	55	09/78	3,601	2,226	5,827	NA
	1000-L, XL	16	T	2	10	06/79	1,320	1,130	2,450	NA
	3000-I	16	S	100	200	06/79	1,420	880	2,300	X
	3000-II	16	S	100	200	11/72				X
continued on next page	3000-III	16	S	92	200	06/78	2,309	989	3,298	NA
	3000-33	16	S	58	135	01/79	713	306	1,019	NA

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Hewlett-Packard (continued)	3000-30	16	S	50	105	10/79	1,038	445	1,483	NA
	3000-40	16	S	40	52	11/81	92	40	132	NA
	3000-44	16	S	109	200	03/81	933	400	1,333	NA
	3000-64	16	S	200	300	01/82	0	0	0	NA
						TOTAL	41,225	28,110	69,335	
HIS-GE	30	8	T	7	35	05/69	225	50	275	X
	3010, 2	16	T	13	90	05/70	25	1	26	X
Honeywell	112	12	T	5	10	11/69	222	48	270	X
	116/316/416/516	16	T	8	62	10/66	2,405	1,295	3,700	X
	700 Series	16	T	16	65	06/72	2,114	1,811	3,925	X
	164X Series	16	T	144	440	12/69	20	8	28	X
	6/06	16	T	7	42	01/76				
	6/23	16	T	6	25	--/78				
	6/33	16	T	4	40	05/78				
	6/34	16	T	4	18	01/76				
	6/36	16	T	4	35	01/76	3,720	3,120	6,840	2,500
	6/30	16	T	23	33	02/81				
	6/31	16	T	20	35	02/81				
	6/32	16	T	26	48	02/81				
	6/34	16	T	30	57	02/81				
	6/38	16	T	25	88	02/81				
	6/43	16	S	7	110	01/77				
	6/47	16	S	19	160	08/78				
	6/53	16	S	19	145	05/78				
	6/57	16	S	44	225	--/78				
	6/48	16	S	33	116	02/81	4,160	3,340	7,500	2,200
	6/54	16	S	39	138	02/81				
	6/74	16	S	65	221	02/81				
	6/76	16	S	75	273	02/81				
	6/92	32	S	110	412	10/81	180	40	120	
	6/96	32	S	130	570	10/81				
						TOTAL	12,971	9,713	22,684	4,700
Information Technology, Inc.*	4900/10	16	T	10	20	10/65	25	0	25	X
IBM	Series/1	16	T	5	30	11/76	20,800	8,300	29,100	10,000
Intel	86/330	16	T	2	19	01/82	0	0	0	NA
Integrated Digital Products, Inc.	MiniMate	16	T	8	6	01/82	0	0	0	200
Intersil	LSI 8	12	T	3	7	07/80	18	18	36	NA
Keronix	IDS-16/8	16	T	4	5	04/74				X
	IDS-16/10	16	T	3	5	04/74	2,900	270	3,170	X
	IDS-16/12	16	T	3	4	04/74				X
Lear Siegler*	VDP-410	16	T	4	4	10/78	100	50	150	X
Lockheed Electronics Company, Inc.*	LEC-16	16	T	11	18	03/69	2,590	435	3,025	X
	SUE	16	T	6	11	09/72	2,878	472	3,350	X
						TOTAL	5,468	907	6,375	
Microdata Corp.	400	8	T	3	4	01/70	155	0	155	X
	800 Series	8	T	6	11	05/69	2,055	1,380	3,435	X
	1600	8	T	5	11	02/72	6,825	1,177	8,002	X
	3200/3230	16	S	8	14	03/74	115	110	225	X
	Micro One	8	M	1	3	11/74	800	120	920	X
						TOTAL	9,950	2,787	12,737	
Minicomp*	MD-708	8	T	5	7	08/70	50	0	50	X
Modular Computer Systems	Modcomp I	16	T	2	9	10/71	698	142	840	X
	Modcomp II	16	T	13	41	03/71	2,197	534	2,731	2
	Modcomp III	16	S	13	44	12/70	72	5	77	X
	Modcomp IV	16/32	S	48	100	05/74	339	130	469	X
	Classic 7810	16	T	8	25	05/79	397	37	434	NA
	Classic 7820	16/32	T	16	38	12/80	66	13	79	NA
	Classic 7830	16/32	S	29	55	09/79	262	41	303	NA
	Classic 7840	16/32	S	28	70	12/80	164	36	200	NA
	Classic 7860	16/32	S	38	100	01/78	152	59	211	NA
	Classic 7870	16/32	S	64	128	08/78	327	153	480	NA
						TOTAL	4,674	1,150	5,824	
Motorola Communications Division*	MDP-1000	8	T	8	19	02/69	75	0	75	X
New England Digital Corp.*	Able Series 40	16	T	8	10	06/77	100	25	125	X
	Able Series 60	16	T	10	12	06/78	75	10	85	X
						TOTAL	175	35	210	
Omnitec (Bit)*	480	8	T	6	17	12/66	195	3	198	X
	483	8	T	9	33	01/70	115	40	155	X
						TOTAL	310	43	353	
Onyx	C8002	16	T	19	19	05/80	700	400	1,100	1,200
Perkin-Elmer Corp.	1	8	T	4	11	09/70	210	77	287	X
	2, 3, 4, 5	16	T	9	21	05/67	614	153	767	X
	13, 15, 16, 18	16	T	15	33	09/69	14	14	28	X
	50, 55	16+1	T	7	33	04/72	133	40	173	X
	70	16	T	9	65	12/71	1,108	348	1,456	X
	74	16	T	3	34	02/73	300	56	356	X
	8085	16	T	15	50	07/72	70	18	88	X
	5/16	16	M	1	5	01/77	269	78	347	X
	6/16	16	T	7	15	01/76	1,896	750	2,646	150
	7/16	16	T	3	18	02/74	3,732	840	4,572	X
	8/16	16	T	11	25	01/77	745	196	941	200
	7/32	32	S	15	36	07/74	1,602	470	2,072	200
	8/32	32	S	62	160	06/75	748	281	1,029	150
	Series 16	16	T	7	22	04/79	652	195	847	300
	3220	32	S	34	100	05/79	582	351	933	300
	3210	32	S	50	80	09/81	18	11	29	500
	3230	32	S	65	150	03/81	92	81	173	300
	3240	32	S	100	192	10/79	219	79	298	400
	3250	32	S	150	190	02/82	0	0	0	NA
						TOTAL	13,004	4,038	17,042	2,500

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Name of Manufacturer	Computer Model	Bits Per Word	Size Class	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Plexus Computers, Inc.	P/25	16	T	19	19	06/82	0	0	0	NA
	P/40	16	S	42	40	09/81	10	2	12	NA
						TOTAL	10	2	12	
Point 4 Data Corp.[b]	Point 4 Mark 5	16	T	5	7	03/79	2,550	760	3,310	1,200
	Point 4 Mark 3	16	T	3	4	05/81	125	105	230	1,800
	Point 4 Mark 8	16	T	6	8	11/81	18	6	24	400
						TOTAL	2,693	871	3,564	3,400
Prime Computer	100	16	T	6	12	04/73				X
	200	16	T	7	22	11/72				X
	300	16	S	12	58	09/73	1,500	1,340	2,840	X
	400	16	S	62	207	06/76				X
	500	16	S	126	330	06/76				X
	150 II	32	S	54	65	06 80				
	250 II	32	S	50	75	06/80				
	350	16 32	S	31	116	07 78				
	450	16/32	S	50	75	02 79				
	550	16/32	S	70	105	02/79	2,782	1,828	4,610	2,000
	550 II	16/32	S	75	110	07/81				
	650	16/32	S	95	165	02/79				
	750	32	S	130	200	07/79				
	850	32	S	275	370	07/81				
						TOTAL	4,282	3,168	7,450	2,000
Raytheon Data Systems	703	16	T	13	23	10/66	179	33	212	X
	704	16	T	10	18	03/70	700	200	900	X
	706	16	T	19	30	05/69	75	17	92	X
	RDS 500	16	S	17	21	12/73	1,153	272	1,425	NA
	RDS 550	16	S	14	14	10/80	212	0	212	NA
						TOTAL	2,319	522	2,841	
Redcor Corp.*	RC 70	16+2	T	15	30	07/68	100	40	140	X
SCI Systems, Inc.	Mercury 3	16	T	6	13	--/78	630	70	700	NA
Sperry-Univac	5201	16	T	6	13	09/68	330	170	500	X
	620/a	16	T		75	12/65	120	30	150	X
	520/f, f-100	16	T	10	23	06/70	470	220	690	X
	620i	16/18	T	10	20	12/65	920	380	1,300	X
	620/L+100C	16	T	5	12	02/71	720	320	1,040	X
	620/L-100	16	T	6	14	06/72	1,095	554	1,649	X
	A620/i, R622/i	16/18	T	15	29	06/69	185	80	265	5
	V-72	16	T	10	45	02/74	1,130	453	1,583	20
	V-73	16	S	16	45	11/72	1,190	530	1,720	X
	V-74	16	S	40	80	05/74	210	90	300	X
	V-75	16	S	39	80	08/75	120	50	170	X
	V-76	16	S	8	16	01/76	754	329	1,083	10
	V-77-200	16	M	2	5	01 77	977	371	1,348	280
	V-77-400	16	T	5	28	12/76	326	235	561	X
	V-77-500	16	S	30	60	03/81	100	100	200	300
	V-77-600	16	S	18	65	03/77	1,263	510	1,773	460
	V-77-700	16	S	34	90	03/81	50	50	100	300
	V-77-800	16	S	22	95	03/79	630	416	1,046	575
						TOTAL	10,590	4,888	15,478	1,950
Stratus Computer, Inc.	Stratus/32	32	S	123	200	02/82	0	0	0	38
Systems Computer Corp.*	1000	8	T	1	4	01/71	400	200	600	X
Systems Engineering Laboratories	32/30, 35	32	S	30	80	09/76	180	60	240	
	32/55, 57	32	S	50	125	08/75	570	175	745	
	32/75, 77	32	S	70	150	03/78	900	190	1,090	950
	32/27	32	S	25	60	02/81	100	65	165	
	32/87	32	S	250	350	11/81	25	5	30	
						TOTAL	1,775	495	2,270	950
Tandem Computer, Inc.	Non Stop	16	S	95	140	05/76	2,202	737	2,939	NA
	Non Stop II	16	S	144	200	01/81				
Telefile Computer Products	TCP-16/5	16	T	12	15	09/77	170	70	240	60
Texas Instruments	960-A/B	16	T	14	30	12/71	3,900	1,850	5,750	X
	980-A/B	16	S	17	40	10 72	3,950	1,750	5,700	X
	990/4	16	M	1	8	06/76	7,705	2,735	10,440	NA
	990/10	16	T	20	25	03/76	15,310	6,490	21,800	NA
	990/5	16	M	3	8	03/79	3,090	1,600	4,690	NA
	990/12	16	S	29	70	11/79	1,610	670	2,280	NA
	DS 990 Model 1	16	M	11	16	05/79	3,625	1,525	5,150	NA
	770, 771	16	M	7	12	05/79				NA
						TOTAL	39,190	16,620	55,810	
Unicom, Inc.*	CP-8	8	T	3	8	02/70	343	165	508	X
Unicomp*	Comp-16	16	T	11	29	06/70	26	0	26	X
	Comp-18	18	T	12	38	08/70	38	0	38	X
						TOTAL	64	0	64	
Westinghouse Electric	P-50	14	T	16	23	08/64	182	40	222	X
	P-2000	16	T	10	27	08 69	111	90	201	X
	2500F	16	T	10	30	11/71	339	133	472	5
						TOTAL	632	263	895	5
Xerox*	CE-16, 16A	16	T	8	23	06/69	35	10	45	X
	Sigma-2	16	T	24	125	12/66	170	80	250	X
						TOTAL	205	90	295	
							U.S.	International	World	
TOTAL							567,916	277,861	845,777	

NOTES: a) Two Pi Corp. was purchased by Four-Phase Systems, Inc., during 1980.
b) Corporate name changed from Educational Data Systems, March 1, 1980.
*) Not currently active in manufacturing or marketing minicomputers.
NA) Data is not available.
X) Indicates minicomputer models not in new production.

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• AMDAHL ENTERS STORAGE BUSINESS. After attempts to merge with Memorex and STC failed, Amdahl has, as expected, looked to Fujitsu for its peripheral products. First out the door will be an IBM-compatible version of Fujitsu's popular 10.5 inch Winchester, which offers 3350-type capacity, but has densities that approach the 3380. The 6280 drive will be marketed to both Amdahl and non-Amdahl customers and shipments have already begun. The peripheral controller being used is also made by Fujitsu.

• GEISCO PICKS IBM PC. General Electric Information Services Company will purchase some $10 million worth of IBM's Personal Computers for use by GEISCO clients. The desktops will be used in conjuction with GEISCO's teleprocessing and data base services. The GEISCO network is used by 6,000 customers in 750 cities around the world. Links to Apple IIs and TRS-80s are also available.

• NCR ENTERS 32-BIT CHIP RACE. As evidence that it is serious about the merchant semiconductor business, the Dayton manufacturer will be among the first to offer a 32-bit microprocessor. NCR claims that the NCR/32 can replace small and medium-sized mainframes since it has emulator and virtual machine capabilities that will allow it to run existing software. The pitch will be that it combines the best of VLSI with three generations of mainframe experience. NCR claims the /32 will have one of the fastest clock times in the industry; memory management and floating point support chips, and a high-speed (up to 50 MB per second) bus will also be available. Samples will be available in the first quarter of 1983, with volume shipments following in the second quarter.

• HITACHI CLAIMS WORLD'S FASTEST SUPERCOMPUTER. Claiming a top speed of 630 million floating point operations per second (630 Mflops), Hitachi's S-810 family will hit the Japanese market in early 1983; no plans for international marketing have been announced. Fujitsu claims 500 Mflops while the Cray X-MP and CDC 205 are rated at 400 Mflops. NEC is expected to join the race soon.

• CRAY SLASHES SUPERCOMPUTER PRICES. In response to the entrance of both Fujitsu and Hitachi and using a MOS-based version of the Cray-1/S, Cray has cut its prices in half. The new Cray-1/M prices will range fron $4 million to $7 million, compared to $8.5-$13.3 million for the Cray-1/S. Prices for the top of the line Cray X-MP have been cut by about 20% to $9- to $11 million from the previous $11.4-$14.5 million range.

• MITEL SHOWS ITS EXECUTIVE WORKSTATION. In what will be the start of a series of new workstations from PBX vendors, Mitel has combined voice and data services in its Kontact workstation. Kontact is designed to handle electronic mail, time management, financial planning, data communications and word processing with traditional voice/PBX capabilities. Mitel's efforts have taken on new import since the announcement of its cooperation with IBM for PBX/local network technology (see EDP/IR, Vol.18, No.8, page 8).

• IBM TO BUY INTEL 64K RAM TECHNOLOGY. Despite the dominance of Motorola and Texas Instruments in the U.S. 64K RAM market, IBM has looked to Intel for HMOS tapes and process know-how. Though IBM uses its own 64K RAMS in its 4300s and System/38s, those RAMS are believed to be too slow for both large machines and the small systems coming on line. Intel is also IBM's chief microprocessor supplier for its Personal Computer, Displaywriter, and Datamaster.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

MOLLY UPTON, EDITOR AUGUST 24, 1982 ● VOL.18,NO.9 P.J. MCGOVERN, PUBLISHER

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LAWSUITS AND POLITICS GRAB HEADLINES AS EUROPEAN MARKET COPES WITH RECESSION

European governments have always had to weigh conflicting views of their local computer industry. While pride tempts them to resist accepting a role as a ward of the IBM state, IBM's importance as an employer, taxpayer, and supplier necessarily commands respect. At the same time, pressure to support domestic computer concerns has added the volatile political implications of subsidies, preferential buying, and even nationalization.

Prolonged recessions merely aggravate the old sore spots. Too many grandstanders have wrongly labeled computers as an inexhaustible fount of future jobs, and thus hard economic times inevitably lead to calls for government assistance. The failure of European firms to keep pace with U.S. and Japanese competitors fuels a search for scapegoats, and the hostilities of non-DP trade disputes are eventually dragged into the fray. The debate gets shrill.

Despite the steady 20% growth of the European market, U.S. and Japanese successes are giving the Europeans the urge to tinker. France has its nationalization scheme; the U.K. is propping up ICL; and all the information processing world waits for the European Economic Commission's decision whether or not to press for IBM reform. On the other hand, U.S. firms say they're being discriminated against in the U.K. That these events are of little interest to users demonstrates the politicization of the industry. Some points of note:

- If IBM loses the court battle, the biggest winners will be U.S. and Japanese firms: Europeans do little PCM manufacturing.
- IBM controls some 35% of the European market; it is also the leading vendor in all European nations except the U.K.
- The strongest dollar in 10 years has decimated U.S. overseas earnings, but has done little to spur European exports.
- The European growth is in the small systems arena, with desktops, minis, and SBCs all growing at over 20% through 1986.
- User spending habits in Europe closely resemble those in the U.S., except for lower spending for staff and more for outside services.

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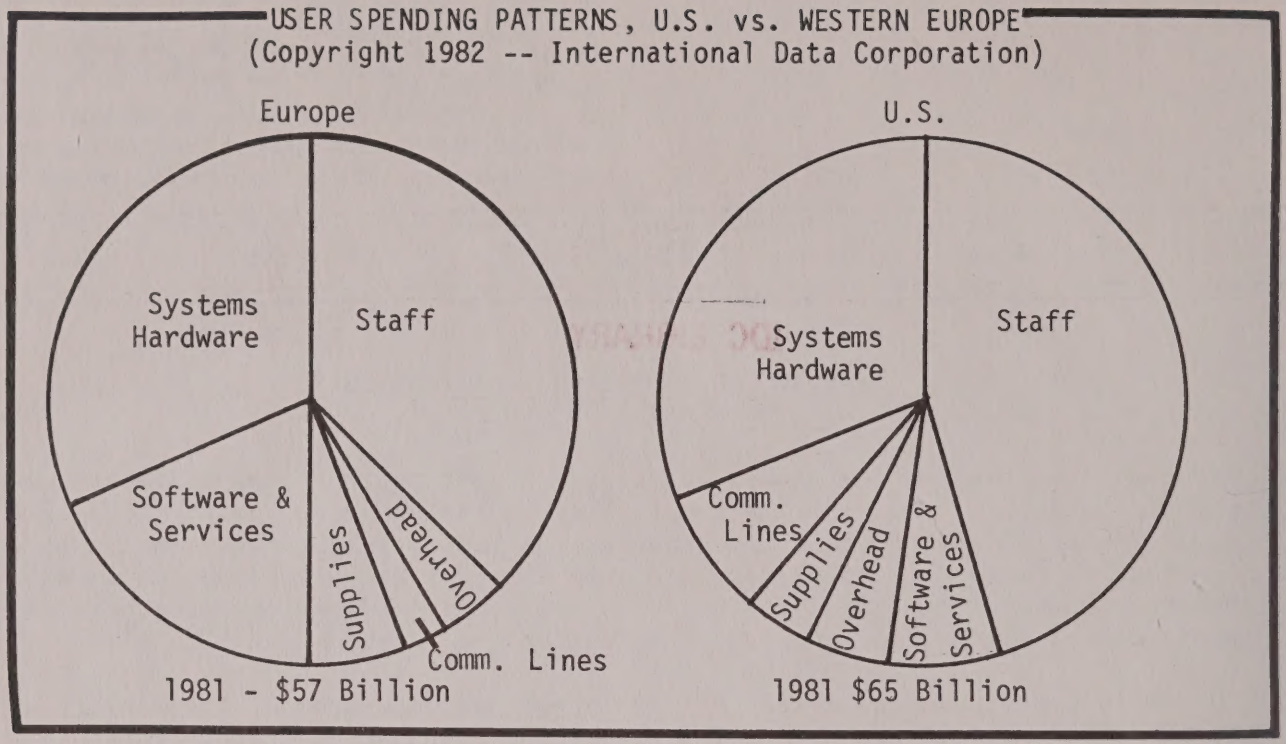

The chief difference between the user spending habits in the U.S. and Europe is that U.S. firms spend more on staff and the Europeans spend more for outside software and services. U.S. firms are also spending more on data communications line charges. Both markets are increasing at about 20% per year.

A look at specific industry spending shows further similarities. Both sides of the Atlantic spend a little over one percent of corporate revenues on MIS DP. Manufacturing is the largest single user segment, followed closely by business services. In terms of the value of computers installed per employee, banking and finance is the most heavily computerized sector. Both the U.S. and the Europeans have installed approximately $1,000 worth of computers per worker, although the figure varies greatly between industries.

The growth in small systems

Mainframe growth in Europe will only be about 8% per year through 1986, and thus the expansion of the marketplace will come from the sale of small systems. As in the U.S., desktops are the fastest growing sector, but although the value of desktop shipments is growing at some 33% per year, the $1 billion European market is only about half that of the U.S. IDC expects that this percentage will slip to about one-third by 1986.

The European small business computer market, on the other hand, is growing faster (21%) than its U.S. counterpart. By 1986 the value of SBC shipments will exceed those in the U.S., $4.4 billion to $3.1 billion. In 1981 the U.S. SBC market was slightly larger than in Europe, $1.9 billion to $1.6 billion.

The overall strong showing of small processor systems continues into the minicomputer area. IDC expects that the value of Western Europe's minicomputer shipments will increase at a rate of 21% through 1986, when it will reach more than $5.2 billion, up from a little over $2 billion in 1981. The U.S. minicomputer market is nearly twice that size and will remain so through 1986.

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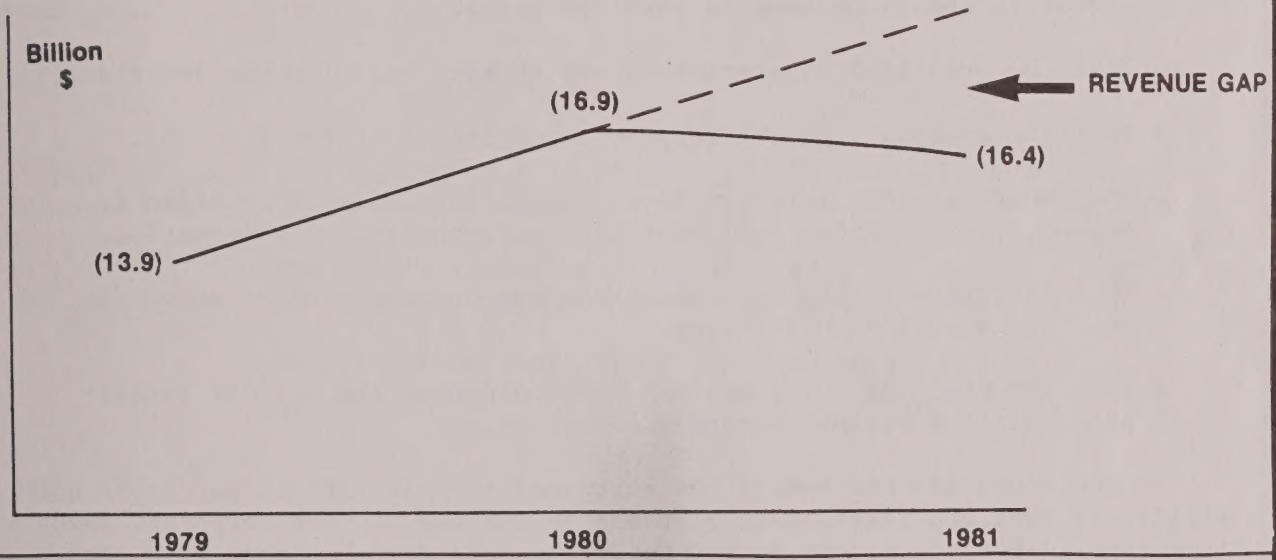
THE TOP NINE EUROPEAN COMPUTER FIRMS, 1981

Company	Sales ($000)	Assets ($000)	Net Income ($000)	Stockholders Equity ($000)	Employees
Siemens*	16,029,835	14,653,409	208,157	3,693,591	338,000
IBM Deutch.	3,506,962	2,452,670	239,884	625,562	27,263
IBM France	3,196,009	2,023,548	155,764	927,258	20,596
Rank Xerox	2,669,092	2,420,786	256,344	1,291,669	33,781
Olivetti	2,569,919	NA	NA	NA	53,471
IBM U.K.**	2,030,844	NA	166,197	NA	15,000
ICL	1,530,721	914,482	-286,512	129,095	25,564
CCI/HB	1,359,630	1,492,479	-83,132	229,421	21,198
Nixdorf	858,755	1,030,746	17,785	236,982	14,760

*Less than 10% of revenue from DP. **Includes sales to foreign affiliates of IBM. Source: Fortune Foreign 500, 9/23/82.

EFFECT OF DOLLAR EXCHANGE RATE ON REVENUES OF TOP TEN EUROPEAN SUPPLIERS



MAJOR WORLD ECONOMIES AT A GLANCE (as of July 1982)

	Industrial Production	Inflation Rate	Unemployment Rate	Local Stock Exchange	Exchange Rate/$	Prime Rate
W.Germany	-1.0%	6.0%	5.4%	-7.3%	2.45	12.0%
France	+2.5	14.0	8.3	-4.0	6.82	14.0
U. Kingdom	+3.5	9.0	12.3	-2.6	1.74	13.0
Italy	+2.0	15.5	10.3	-22.4	1,373	22.5
Sweden	-1.5	8.5	3.0	-4.8	6.10	
U. States	-9.5	6.5	9.5	-17.9	1.00	16.0
Japan	+1.5	1.5	2.4	-14.3	254	6.0
Australia	-5.5	10.5	6.5	-27.3	0.99	
Canada	-10.5	11.0	10.9	-39.5	1.26	17.0

Notes: production, inflation and stock rates are over the last 12 months.
Source: The Economist.

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The IBM case in Europe

Although IBM has an impressive record in its antitrust battles, it still views the European inquisition as potentially dangerous. The laws in Europe are not necessarily the same as in the U.S., and, unlike the U.S. situation, IBM must deal with governments well accustomed to meddling in business affairs. Many Europeans see the decision as the key to shaping their industry for the next decade, and they do not like the image of a dominating, monolithic IBM.

Thus, even though the case materials and issues in Europe are similar to the ones dismissed in the various U.S. cases, a parallel outcome is by no means assured. Consequently, IBM has unleashed its full defense arsenal. At private hearings in February, no less than Cyrus Vance, Frank Cary, Thomas Barr, and a letter from the office of Alexander Haig surfaced. (Vance sits on the IBM board.) IBM's defense sounded many familiar refrains:

- That the computer market is highly competitive, and that IBM should be treated like any other supplier.
- That a minimum amount of main memory is necessary to the system and therefore should be bundled into the price.
- That the principal benefactor of any changes would be the Japanese.
- That the Europeans should respect the opinions of the U.S. DOJ.
- That what is often referred to as simple interface information is actually very complex and involves key technological information.
- That interface information often changes between product announcement and actual manufacturing.
- That any discrimination against IBM would pave the way for retaliatory actions against European companies.

In addition, IBM can remind the Europeans that in 1981 it paid some $500 million in European taxes, making it one of the the top ten corporate taxpayers in Europe. It also employs 85,000 Europeans, and does business with some 40,000 European suppliers. Any changes that hurt IBM will ripple through much of the European economy.

IBM's opponents counter that IBM sold the 370/155, and /165 with unbundled memory, and thus its current policy can only be for anticompetitive reasons. They also believe that the opening up of IBM interface standards would give a tremendous boost to innovation which would be beneficial to European firms. Without such standards, IBM will retain its lock on the mainframe world.

With IBM's steady unbundling of software, and with the ever decreasing cost of memory, it is the interface issue that is the cornerstone of the case. And given IBM's forthcoming extended architecture and dynamic channels, interface issues are a key PCM worry. With ICL and Siemens selling Fujitsu mainframes, and BASF and Olivetti selling for Hitachi, pressure for easier connections could become considerable. The EEC decision will involve the highest levels of government, and could have as many political as information processing consequences. Prompt action is desirable, but not likely.

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IBM MARKET SHARE BY COUNTRY AND REGION, 1980
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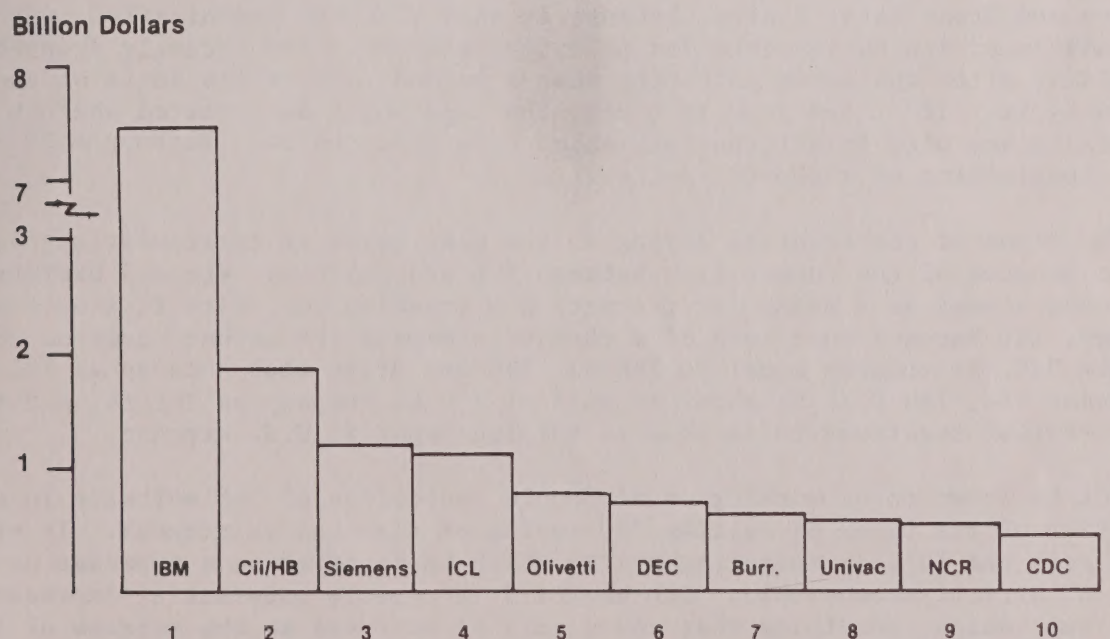
	Total DP Revenue	IBM DP Rev. $M	IBM Share	Leading Compet.	Comp. DP Rev.	Comp. Share
W.Germany	$5,612	$2,135	38.0%	Siemens	$791	14.1%
France	4,228	1,390	32.9	CII/HB	843	19.9
U.K.	3,993	978	24.5	ICL	999	25.0
Italy/Greece	2,400	887	36.9	Olivetti	633	26.3
Benelux	1,901	750	39.5	CII/HB	134	7.0
Scandinavia	1,685	650	38.6	Datasaab	136	8.1
Switz/Austria	1,351	550	40.7	NCR	148	11.0
Spain/Port.	930	35	37.6	Olivetti	125	13.4
Total	22,100	7,690	34.8		3,810	17.2

With European revenues of four times that of its nearest competitor, CII Honeywell Bull, IBM is easily the dominant vendor in Europe. But on a nation by nation basis, its rule is less complete. IBM's share of the major European markets is remarkably consistent. With the exception of the U.K., where it has just 25%, it has between 32% and 40% of each Western Europe market.

IBM vs. NEAREST COMPETITOR, WESTERN EUROPE, 12/80
(Copyright 1982 -- International Data Corporation)



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BACKGROUND AND DETAILS OF THE EUROPEAN CASE

The European investigation (it's not a real suit yet) into IBM practices has its roots in the Telex victory in 1973. After that decision (since overturned) Amdahl, Memorex, and Itel complained of IBM practices in four areas: bundled main memory and operating systems, installation productivity options (IPOs), and interface standards. No European companies were among the complainants.

After some six years of investigation, in December of 1980 the European Economic Commission filed a 1,000 page statement of objections concerning the four areas above. In August of 1981, IBM filed its written response, and in February of 1982 closed hearings were held in Brussels. Now the commission must decide whether to seek judicial action against IBM. If the commission rules against IBM, the case will move to the European Court of Justice in Luxembourg which handles EEC affairs.

As in the U.S., the case has dragged on to the point where some of the issues have become irrelevant. National Advanced Systems (originally Itel) dropped out when IBM changed its IPO policy, and IBM's continued software unbundling has reduced that concern. Interface standards are the key. In the Memorex case, U.S. courts upheld IBM's position on interface standards, and thus the European decision could directly conflict with U.S. law, a nasty complication. No one knows when the EEC will make up its mind, but a final negative ruling against IBM is unlikely before 1984, meaning the PCMs will have to deal with the extended architecture with their own resources.

The other cases on the block

Perhaps being a little tired of always being on the wrong line of the affidavit, IBM had mounted a little suit of its own. It claimed that the British government had favored ICL equipment in violation of the "open tender" principles agreed upon by the EEC in early 1981.

Specifically, IBM attempted to block the sale of a $30 million system to the Severn and Trent Water System, because it said that the organization overruled the advice of its own experts for political reasons. IBM recently dropped its complaint after the Water Authority took a second look at its decision and stood by it. If it had gone to court, the case would have tested whether there is really any bite to all the talk about open procurement. Burroughs is also complaining of a pro-ICL policy.

The issue of preferential buying in the U.K. takes on particular significance because of the recent link between ICL and Fujitsu. Whereas preference was once viewed as a means for protecting a troubled ICL, with Fujitsu's technology, ICL becomes much more of a threat to expand its market position which in the U.K. is roughly equal to IBM's. IBM can argue that because of ICL's Japanese tie, IBM U.K. is about as much of a U.K. company as ICL is, and that preferential treatment boils down to helping Japan at U.S. expense.

ICL is known to be working on microcode emulations of IBM software in anticipation of its sales of Fujitsu 380 series of high-end mainframes. It will also sell the Fujitsu operating system which is descibed as a superset of MVS, but not strictly compatible. ICL has said it expects substantial increases in mainframe sales, something that could only be achieved at the expense of IBM. In the 1980s, the U.K. could become a key PCM battleground.

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WESTERN EUROPE IBM GENERAL PURPOSE INSTALLED BASE, 1978-1986
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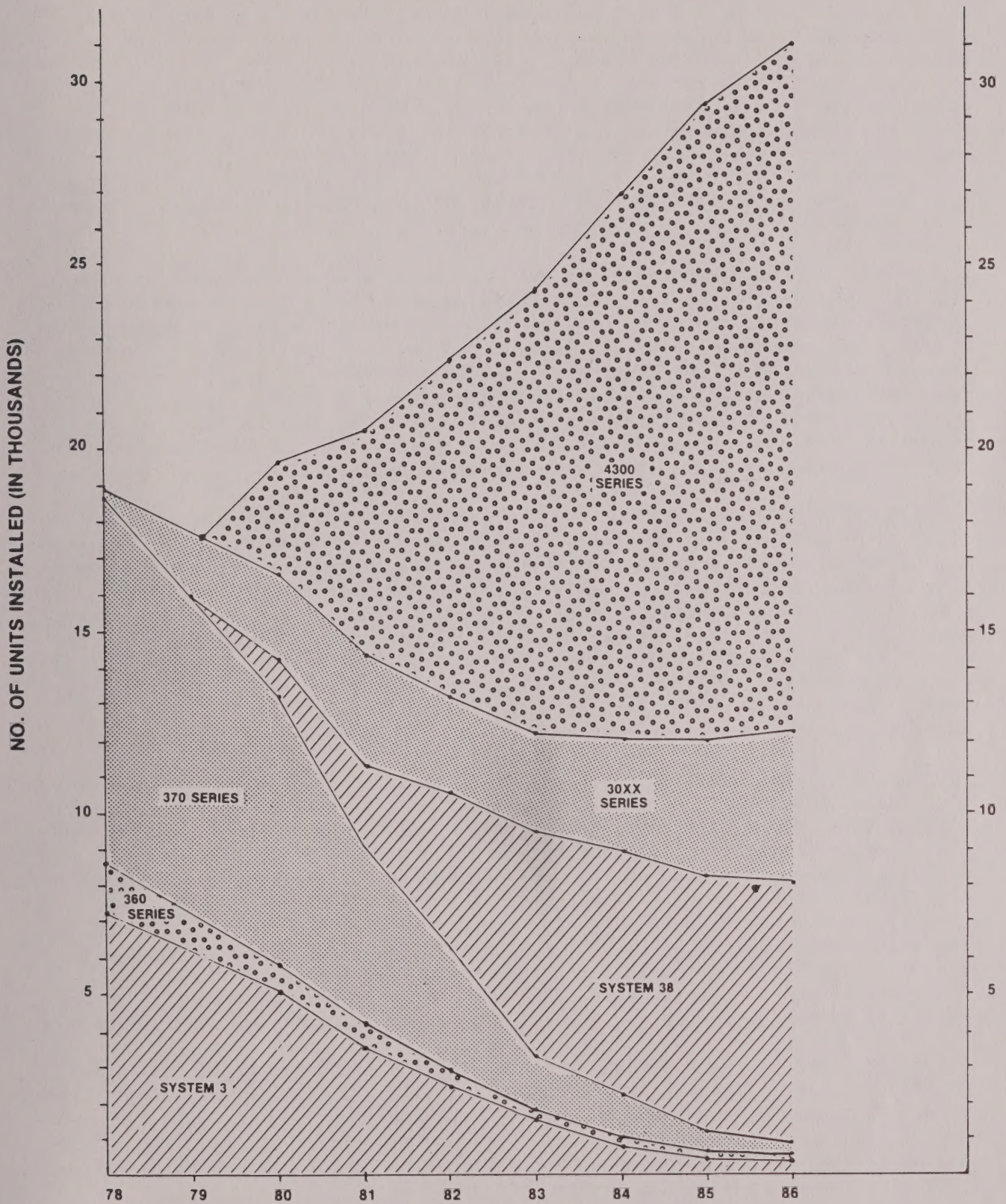

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• AT&T AND JUSTICE TO ACCEPT SETTLEMENT MODIFICATIONS. In a surprisingly accommodating stance, the two parties seem prepared to fully accept the modifications proposed by Judge Green. In a 178-page ruling, the Judge called the agreement "plainly in the public interest," but said it needs the following modifications: the Bell operating companies should get the lucrative Yellow Pages business; permission to sell customer premises equipment; and have the right to petition the court for future competitive leeway. AT&T will be banned from electronic publishing for seven years, and its long distance competitors must get equal access to local facilities, or compensating discounts. In addition, the judge intends to monitor the agreement's implementation.

As such, the agreement falls about halfway between the original settlement and the provisions of the recently withdrawn HR 5158. Both AT&T and Justice are still concerned over the local operating companies selling equipment, especially sophisticated high-ticket items which require local operating company installation support, but apparently this is not enough to prevent acceptance. Down the road, the loss of the Yellow Pages may have lasting impact. Many saw the profitable $3 billion business as AT&T's vehicle into the home and the bridge to services such as daily news and classified ads. Under local control, the introduction of such products is likely to be slowed.

• SYNAPSE USES MICROPROCESSORS TO OFFER MAINFRAME POWER. Claiming to be the first firm to build a large-scale CPU that takes full advantage of microprocessor technology, California-based Synapse has introduced its N+1 system, aimed at the transaction processing marketplace. Using multiple Motorola 68000s and a bus architecture, Synapse claims users can configure a redundant system with processing power ranging between a Vax 11/780 and an IBM 3081K. Pursuing the market of Tandem and Stratus, Synapse, with financial backing of some $14 million, says it will sell direct and to systems houses which will add the software needed to sell to vertical markets. System prices start at $340,000 including peripherals. First shipments are scheduled for 4th quarter 1982.

• BURROUGHS INCORPORATES SDC. Merging its Federal and Special Systems Group with System Development Corp. (acquired in 1981), Burroughs has come out with "System Development Corp. -- a Burroughs Company." The new unit will be headquartered in Camarillo, CA. Heading the group will be Dr. George Mueller, currently chairman and CEO of SDC; the new SDC is expected to have revenues of some $500 million a year and employ more than 6,000 workers.

• UNIVAC RESHUFFLES MINICOMPUTER FORCES. In the final dismantling of the Varian group, Univac is moving its minicomputer operations, formerly in Irvine, CA, to its Blue Bell, PA and Salt Lake City groups. The move will result in personnel reductions. The Irvine group currently employs 186 people.

• XEROX SHOWS NEW AI PROCESSORS. At the National Conference of Artificial Intelligence in Pittsburgh, Xerox showed its 1108 and 1132 scientific processors. The company says the $30,000 1108 with the Interlisp language, 1MB main memory and 10MB Shugart drive may spur the use of expert systems. The 1132 has up to 8MB memory, a 70 nanosecond instruction time, a memory bandwidth of 530MB per second, and an 8KB cache. Prices start at $179,000.

• IBM DOUBLES PC'S MAIN MEMORY. Personal computer users can have up to 512K.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

MOLLY UPTON, EDITOR AUGUST 12, 1982 ● VOL.18,NO.8 P.J. MCGOVERN,PUBLISHER

IBM's new leasing schemes -- page 5

UNIVAC FINALLY PLAYS ITS HAND; UNVEILS HIGH PERFORMANCE 1100/90 SERIES

At a time when distributed mini and micro systems are attracting increasing vendor attention, Sperry Univac is betting its future on one simple and proven premise. More MIPS. To Univac, the high end is still alive and power hungry, and any mainframer that provides the hardware and software punch can expect to keeps its customers, and maybe even find some new ones.

Though the technical details of Sperry's new multiprocessor 1100/90 series are impressive, the real story lies in Univac's clear statement of future direction. The company will focus on the mainframe and distributed processing requirements of six basic industries: manufacturing; government; distribution; airlines; energy; and finance. It will meet these needs through a combination of a broad range of processing power, high level data base software; supercomputers, and specialized data base and array processors. In the words of a Univac VP, Univac must now be recognized as a "heavy contender in the MIPS war."

The new series comes none too soon. Users of Sperry's four-year old 1180 series have topped out and need more power, while the delay in bringing out a new line of CPUs has slowed cash flow at a time when the company's farm machinery business is hurting. Though 1100/90 series deliveries are still a year away, the promise of up to 25 MIPS of procesing power and new data base software should keep the company's installed base in line. Some points of note:

- In an unusual pitch, Univac is making specific comparisons to IBM machines, boasting twice the power and main memory of the 3081K. The 1100/90 series matches IBM's 308X series on a $/MIP basis.
- Univac estimates that the 1100/90 series will draw some $5.5 billion out of its current customer base over the next 5 years.
- Worries about Univac's lack of disk expertise are lessened by the new 2 gigabyte boxes, each containing four drives.
- User's of Univac's 90/XX series and VS/9 operating system are still without a clear upgrade path.

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COMPARISONS: LATEST IBM, CDC, UNIVAC MAINFRAME FAMILIES

	IBM 308X	Univac 1100/9X	CDC 8XX		IBM 308X	Univac 1100/9X	CDC 8XX
MIPS	4-15	7.5-25	0.9-30	Disk Capacity	2GB	2GB	1GB
Addressing	24/31	24/18	21	Max. Memory	32MB	64MB	2MB
Logic	TTL	ECL	MOS	Memory Chips	16K	64K	64K
Cache	64K	64K	4K	Transfer Rate	3MB/sec	4.3MB	4.5MB
Cooling	Air/ Water	Liquid	Air/ Freon	Max. Channels	24	40	12
				Multiprocessor?	No	Yes	Yes
$/MIP	$350K	$350K	$210K	First Available	4Q/81	2Q/83	2Q/82
# Models	5	4	6	Price Range ($M)	1.3-5.5	2.8-10	.4-4.6

Since IBM, Univac, and CDC have brought out full families of large scale processors within the last eight months, now is a good time to compare technological trends. Since the latest lines from Burroughs and Honeywell have not come out, those two companies have not been included. A new Honeywell mainframe line is expected before year's end.

Overall, the figures demonstrate the difficulty of comparing different vendor's machines with varying memories, channel options, addressing, etc. Perhaps the most startling figure is CDC's claim of approximately $210,000/MIP for its 800 series in minimal configurations, significantly less than the roughly $350,000/MIP offered by the IBM and Univac lines. EDP/IR cautions, however, that MIP measurements are not always the best measure of machine performance and can vary greatly according to the nature of the task at hand. Prices for representative systems are provided below:

UNIVAC, IBM, AND CDC POWER AND PRICES* ($000)
(Including operator console and prerequisites)

UNIVAC	IBM	CDC
	3083E - 4 MIPS (8C/8MB) - $2,050	825 - 0.9 MIPS 12C/262K** - $370
1100/91 - 7.5 MIPS (12C/8MB) - $2,865	3083B - 6 MIPS (16C/8MB - $2,200	835 - 2.4 MIPS (12C/524K) - $820
1100/92 - 14 MIPS (16C/8MB) - $4,784	3083J - 8 MIPS (24C/16MB) - $3,150	855 - 7.6 MIPS (12C/524K) - $1,935
1100/93 - 20 MIPS (20C/16MB) - $7,112	3081D - 10 MIPS (24C/16MB) $4,150	865 - 10.7 MIPS (12C/262K) - $2,465
1100/94 - 25 MIPS (20C/16MB) - $8,991	3081K - 15 MIPS (24C/16MB - $4,750	875 - 19.3 MIPS (12C/262K) - $3,230
		875 (dual) - 30 MIPS (12C/262K) - $4,580

Notes. *Univac and CDC MIP ratings have been provided by vendor. IBM figures are IDC estimates. ** CDC memory sizes include 60-bit words; Univac and IBM memories are for traditional 8-bit words.

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DETAILS OF THE 1100/90 SERIES

The series -- There is really only one CPU, the 1100/91; the /92, /93, /94 are two, three, and four processor versions. The power range is from 7.5 to 25 MIPs. Processing power increases 54-fold over the entire 1100 series that begins with the 0.5 MIP 1100/61, and all machines use the same operating system. Univac says the /91 compares with the IBM 3083J; the /92 equals the 3081K; the /93 is 50% more powerful than the 3081K; and the /94 has nearly twice the power of the 3081K.

The technology -- the 1100/90s are the first Univac CPUs to use 64K memory; the circuit switching is five times faster than the 1100/80, the logic density ten times greater. Univac's traditional strength in multiprocessing is evident in its claim of 90% efficiency in multiprocessing configurations. The CPU logic uses .37 nanosecond ECL gate arrays. The entire CPU occupies 1.5 cubic feet and has a 64K cache. Maximum memory is 64MB, and up to 40 byte or 24 block multiplexer channels can be attached per CPU with data transfer speeds of 3.7MB and 4.3MB/second respectively. The system uses liquid cooling.

The architecture -- Like the 1100/80s, the /90s use 36- and 72-bit architecture. The addressing however is expanded to 24-bits, up from 18-bit; 18- and 24-bit programs can be run concurrently. Univac says that it will evenutally move to 36-bit addressing. In multiprocessor arrangements, each machine shares all memory and I/O devices, allowing for redundancy.

What's happening at Univac

After a remarkably quiet 1981, Univac has made its share of headlines in 1982. It has introduced both a low-end 1100/61 B1 which competes with the 4331-2, as well as a new CAD/CAM system. It has made a deal with Floating Point Systems to interface that company's array processor with Univac 1100 systems and it has signed a development and manufacturing pact with Mitsubishi Electric. There has also been the addition of CP/M to its UTS 40 terminals, and a new terminal targeted specifically at the airline industry. A major reorganization took place in April.

More activity is said to be on the way. An office system (the Distributed Office Processing System) was originally expected to appear this fall, but will probably be delayed to the end of the year. New array processors are in the works: a supercomputer is tentatively targeted for early 1983, and Univac's data base machine will be unveiled in a series of announcements starting in early 1983. A new low-end member of the 1100 family, code named Chapparal, will be aimed at distributed processing applications. Software unbundling begins in earnest with the 1100/90s. Computer services similar to CDC's Cybernet are also under consideration.

Sperry's industry specific strategy is now five years old. The six targeted areas represent 75% of Univac's revenues, with the leader being manufacturing which has been growing at 30% per year for the last four years. In energy, Univac reports strong sales of its array processing systems, the first of which was delivered to Shell Oil this past February.

But all is not so rosy. The upgrade for the 1100 series was overdue, but at least users knew it was coming. Less secure are the large number of 90/30, /40, etc. users who are also looking for a follow on. There has been much

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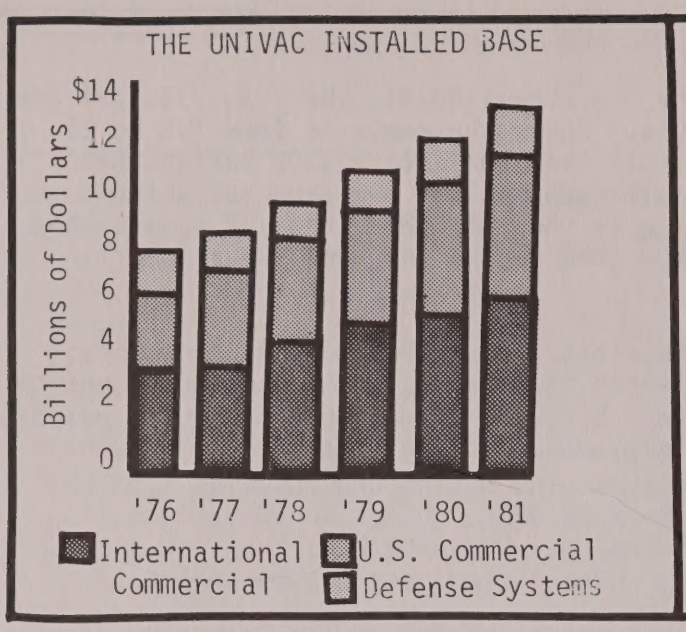

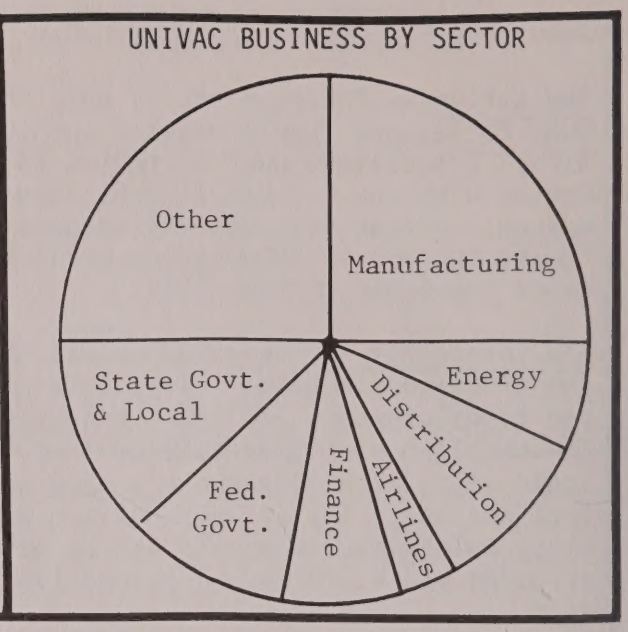

speculation that Univac has decided to try to force all its customers into the 1100 series fold so that it will eventually only have to support one operating system. But conversion from the 90/XX series' VS/9 operating system to the OS 1100 is very difficult, and users will be reluctant to migrate.

To help stem the worry, Univac has made a policy statement to the effect that it will give users a five-year notification of any changes in its policy toward VS/9, and that no such notice will be given before December 1983. But no new hardware is expected any time soon, and if users are forced to convert to the 1100 series, Univac may lose some of its customer base. IDC estimates that the 1981 installed base of 90/XX machines was worth some $2 billion.

Financially, Univac revenues fell 5% for its first quarter (Sperry's fiscal year ends March 31), and the company projects an off year for 1983. It recently announced a one percent reduction in its worldwide workforce, laying off 3,900 workers in marketing, manufacturing, and development. For fiscal year 1981, Univac revenues were up 9% to $2.7 billion (Sperry does not break out the earnings of its divisions). For the future, Univac sees the value of installed mainframes growing at 10%/year to $217 billion by 1986 when Univac sees itself as a $5 billion company, implying a compound growth rate of 13%.

Conclusion

The arrival of big new systems from Univac and CDC begs the question of when IBM will throw its 308X series into full gear. EDP/IR expects that within the next twelve months, IBM will move its line up into the 25 MIP range, most likely through multiprocessing configurations.

As for Univac, it now has at least put up a defense of its 1100/90 base. Still wincing from its unsuccessful acquisition of Varian, it does not intend to offer low-end systems such as personal computers and office automation, except in conjunction with its larger systems. The company sees itself as a systems house, not a retailer. It has stated that easy manipulation of the corporate data base will be a key to its success and is investing heavily in new software products. Univac's future lies with its mainframe customers, so the 1100/90 series and its followers better be good.

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NEW LEASING SCHEMES TYPIFY "NEW IBM"; WILL THE GIANT ENTER USED EQUIPMENT MARKET?

> *"Large capital investments are expected to exert pressure on operational cash flow... In addition, cash flows are substantially affected by customer's largely unpredictable decision to purchase or lease equipment. In this environment, the company's ability to generate or obtain cash on a timely basis is of primary importance."* -- 1981 IBM annual report.

That statement explains much of IBM's behavior over the last year or so. Efforts to pump up the cash flow have included volume purchase discounts, expanded OEM operations, and continued lowering of price/lease ratios. Though the first two represent major changes in IBM policy, the recent leasing arrangements with IBM Credit Corp. and a joint partnership with Merrill Lynch may prove to be the biggest moves to date.

The plan greatly expands customer lease options, matching the offerings of third party lessors. And though the initial announcement concerns only low-end products such as the System 38, S/34, 8100, and 43XX, the deal will probably be extended to the giant's 308X line. The consequences for both third party lessors and the used equipment market could be substantial.

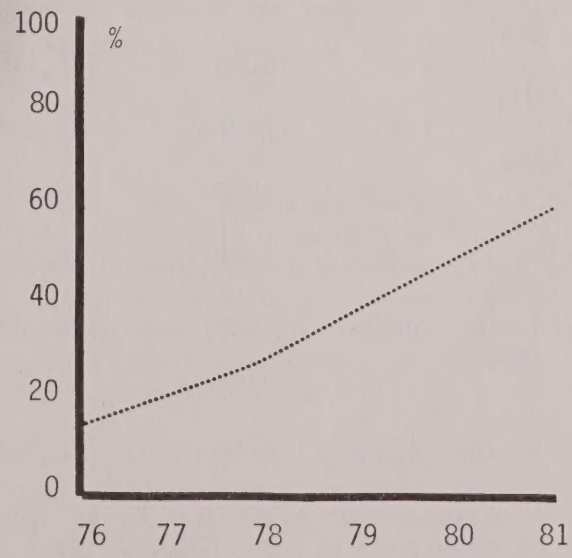
IBM has its reasons for increasing its presence in the leasing business, estimated at some $3 billion per year. The giant is being haunted by its used equipment as lots of 3033 leases expire; lessors have already made their profit on these machines and can afford to write either very short term (6 to 18 month) leases or sell them at rock bottom prices. These prices make the sale of 3081s and 3083s more difficult, especially in a recession.

On the financial side, during 1981, IBM had to put up some $4.6 billion to finance lease and rental agreements. If these transactions were written by IBM Credit Corp., they would have gone onto IBM's books as a purchase, substantially improving both cash flow and short term earnings.

From a manufacturing standpoint, duplicate orders by lessors and IBM customers have always complicated manufacturing schedules. At the same time, manufacturing delays for the 3380 and 3081 allowed lessors to skim off fat premiums for prized early deliveries.

For the customer, the new plans offer greatly expanded leasing schedules as well as favorable ITC options. The user who likes to stay wrapped in a big blue security blanket won't have to write his lease with some third party whose image has been tarnished by the OPM and Itel fiascos. And the security comes at little cost; IDC's Leasing Planning Service has analyzed IBM Credit's rate structure and finds it "very competitive."

% of IBM Third Party Leases, of 1-3 years term, 1976-1981



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IBM'S NEW LEASING SCHEMES

The intention to establish IBM Credit Corp. (IBMCC) as a wholly owned subsidiary was announced in February of 1981, and since May of that year it has been financing IBM installment payment agreements. In those eight months it had gross income of $49 million with earnings of $9.8 million; at year end 1981, it had total assets of $691 million.

The recent announcement will expand the IBMCC's role to include financing non-cancellable leases of at least $100,000. The arrangement will be very similar to that between General Motors and its customer financing division, General Motors Acceptance Corporation (GMAC). Control Data's Commercial Credit operation provides similar services to CDC customers.

Under the arrangement, IBM will sell machines to either IBMCC or a new partnership formed between IBMCC and Merrill Lynch named Greenwich Liberty Ltd., based at the same Stamford, CT address as IBMCC. IBMCC has only a minority interest in this group, meaning much of the cash will come from non-IBM sources.

Through IBMCC or the partnership, the user can get 3,4, and 5 year leases; he also gets the choice of whether to take the Investment Tax Credit (ITC) or let the lessor have it in exchange for a compensating discount. (If the user keeps the ITC -- Plan B -- IBMCC will write the lease; if the customer gives up the ITC, (Plan A) the lease will be written by Greenwich Liberty.) This option will certainly appeal to the many companies which are losing money and thus have little need for tax credits. The chart below compares the options.

A prototype of all this has been underway since last August when IBM began a limited agreement with Citicorp Industrial Credit, covering three purchase only products -- S/23, low-end S/34s, and the Model 102 copier. That plan has been expanded to include the Displaywirter, the 4321, Series 1, and the 5260 retail terminal. U.S. Leasing was also brought in to handle West Coast leases.

Model	$IBM Rental	IBM 2-year Lease	IBM Purchase Price	IBM MMC ($)	IBMCC* 3-year lease A	IBMCC* 3-year lease B	IBMCC 4-year A	IBMCC 4-year B	IBMCC 5-year A	IBMCC 5-year B
4341-10 (2MB)	8560	7285	$178,000	575	5162	5785	4272	4895	3649	4227
4341-11 (2MB)	12150	10340	275,000	750	7975	8937	6600	7562	5637	6531
4341-2 (2MB)	14653	12470	359,000	879	10411	11667	8616	9872	7359	8526
4341-1 (2MB)	9729	8280	225,000	601	6525	7312	5400	6187	4612	5343
4331-11 (1MB)	4880	4155	109,650	324	3289	3673	2713	3097	2302	2659
4331-11 (2MB)	5430	4625	125,350	350	3760	4199	3102	3541	2632	3039
3350 (A2)	1710	1455	41,600	170	1248	1393	1029	1175	873	1008
3350 (B2)	1363	1160	32,940	128	988	1103	815	930	691	798

* Leases under plans A & B carry normal IBM warranties, meaning one year free maintenance for 4300s, 90 days for the other products.

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ACQUISITION METHOD: INSTALLED IBM 3033 and 43XX SYSTEMS, 1981
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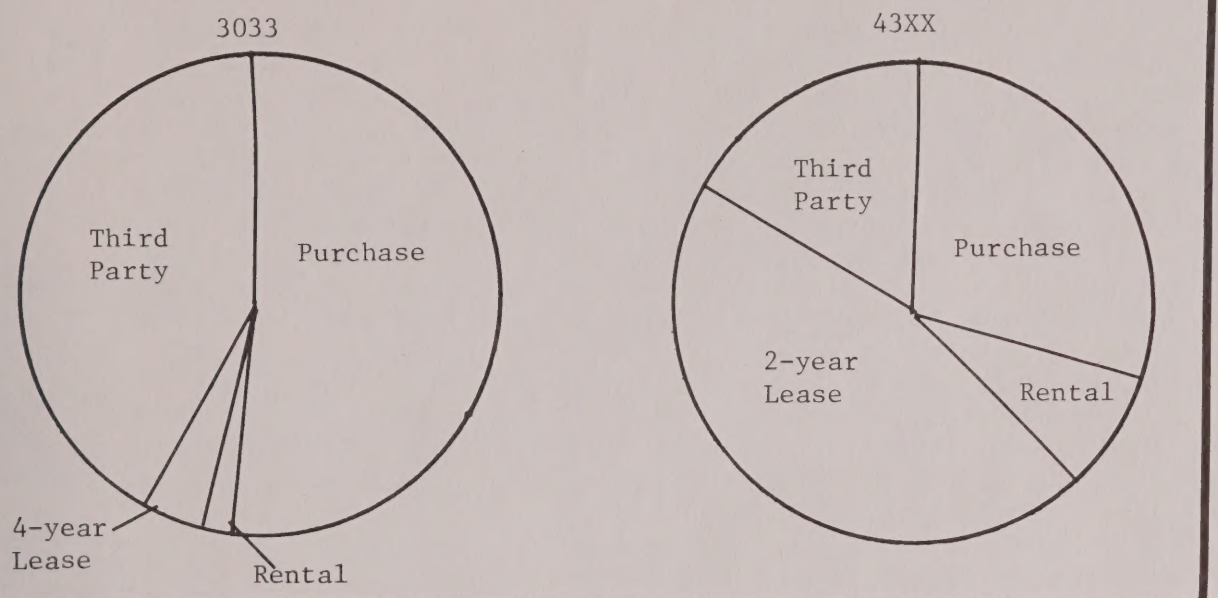

In addition to the IBM name, IBM Credit (IBMCC) will have other significant advantages over its third party competitors. One of the lessor's hardest problems is finding the customer ready to buy; this function will be taken care of for IBMCC by the IBM hardware salesperson. In addition, IBM will handle all administrative and collection activities for the credit group.

But the big question remains. What will IBMCC do with its machines when they come off of their leases? IBM is not saying. In the past, IBM has sold these machines at its new equipment retail prices. Since identical equipment is often available for less than half that in the used market, IBM could only attract its most dyed in the wool customers, and has had to eat a lot of returned equipment over the years. Were IBM to price its used equipment competitively, sellers in the used market would find life considerably tougher.

With the antitrust suit out of the way, IBM may very well decide to try to get some control over the used market. If IBMCC became the dominate lessor of IBM machines, it could either withhold used machines to firm up prices or it could decide to match the lessor's prices, keeping the dollars in house. IBMCC is also expanding the customer's options on expired leases, with expanded buyout and short term renewal options.

Since it will be three years before the first IBMCC machines come off of lease, IBM has plenty of time to decide what to do. EDP/IR sees the following scenario; if, after showing the customer a half dozen financing plans for new equipment, he still prefers a cheaper used machine, then as a last resort IBMCC will sell him one at market rates. Since customers must notify IBM before buying used equipment -- to plan installation and maintenance -- IBM will be able to make its pitch in any used sale that may arise.

In the future, as more and more machines become field upgradeable, the used market will tend to shrink and fewer machines will come back to IBM. Field upgrades will necessitate new types of leases which IBMCC will be well positioned to write. Third party lessors have good reason to be concerned.

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• ONLY IBM, BURROUGHS SHOW 2ND QUARTER MAINFRAMER GAINS. The success stands out sharply against a backdrop of flat revenues and declining earnings. For IBM, second quarter net earnings were up 24%, and revenues were up 17%; Burroughs earnings were up 16%, and revenues were up 27%. For Honeywell the corporate wide figures show earnings down 36% on revenues up 1.4% (the figures do not include one-shot gains from the sale of 27% of CII Bull). Amdahl, which doesn't have much to sell these days, saw earnings drop 86% to a mere $1 million; revenues were down 1%. CDC's computer business net was off 21%, with revenues up 5.7%. NCR earnings were down 3.3%, on revenues up 2%; Univac revenues were down 5%; Sperry does not break out earnings of its various divisions.

• IBM/MITEL JOIN UP FOR PBXS. The two companies have agreed in principle to develop a customized switching system based on the Canadian company's SX/2000 voice/data digital PBX technology. The move will provide IBM with quick access to the PBX market if it so chooses, as well as opening up another local area network option. The Mitel PBX uses advanced technology including Motorola 68000 microprocessors and Intel bubble memories. Both companies stress that the agreement is still only in principle.

• HITACHI PLEADS "NOT GUILTY"; SAYS SUPERCOMPUTER, 31-BIT ADDRESSING COMING. The Japanese mainframer says that it will duplicate IBM's 31-bit addressing, but is still not committing itself to a date. National Advanced Systems still says it expects /XA compatibility a year after IBM's, and it expects Hitachi to do it. The two should get their story straight. Hitachi has also denied reports that it will delay the introduction of its supercomputer because of the recent scandal. The supercomputer is expected to be unveiled in Japan soon and is said to be faster than Fujitsu's, which Fujitsu claims is the world's fastest. Hitachi pleaded not guilty to its alleged crimes.

• VION SCREAMS FOUL. The FBI has left itself wide open for criticism by changing its reason for selecting IBM over National Advanced Systems gear. Originally, the FBI claimed the NAS hardware contained improperly obtained technology; now realizing that the AS/9000 and /7000 use technology developed well before the scandal, it says that the IBM proposal was the better buy. Vion, which markets NAS gear to the government, is vehemently protesting.

• STC DROPS VSS PROJECT. Storage Technology's Virtual Storage System would have used Magnuson 4300-type CPUs to manage the physical retrieval of data, competing with mass storage systems by IBM and Masstor. Magnuson says that it never expected OEM sales for the VSS to amount to a significant business.

• IBIS SUED AGAIN. The 3380-compatible disk start-up had just settled its dispute with STC, when it was promptly sued by Burroughs. The $20 million suit charges Ibis with misappropriating thin film trade secrets. Ibis, naturally, is denying any wrong doing.

• APPLE SUES FAR EAST IMITATORS. Apple has filed a "number of lawsuits" in Taiwan, Hong Kong, and New Zealand to stop the growing business in counterfeit Apple IIs. In Taiwan, the target was Sunrise computers, selling the "Apolo II," while in New Zealand, Orbit Electronics is selling Taiwan-made copies called the "Orange." In compliance with Taiwanese law, Apple had to conduct its own raids in order to gather evidence.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet" IDC LIBRARY

MOLLY UPTON, EDITOR JULY 16, 1982 ● VOL.18,NO.7 P.J. MCGOVERN, PUBLISHER

BABY BELL'S FIRST PRODUCT MARKS BEGINNING OF DEREGULATED ERA; RENAMED ACS FINALLY HEADS FOR THE STARTING BLOCKS

"Net 1 will do for data communications what the switchboard did for voice communications. And it is the cornerstone of our corporate strategy." -- A.J. McGill, Vice President of Business Marketing, AT&T.

Thirty years from now, he'll have been proven right, and the deregulation of AT&T will be seen as a key inflection point in the history of the information industry. Despite all that computers have accomplished to date, until data can be freely exchanged between different individuals, organizations, and machines, the nation will not become a true "information society." And AT&T is perhaps the one organization capable of bringing this about.

But the question remains one of timing. AT&T didn't dump the telcos for nothing, but it may have to wait a while for the deal to pay off. After all, 37 years passed between the invention of the telephone and the granting of AT&T's monopoly status in 1913. Who would dare speculate what the world will look like 37 years after deregulation?

Although American Bell's Advanced Information Systems/Net 1 offers little that can't be obtained from today's processing services vendors, it has the potential to eventually reshape the way America does business. Vast inter- and intra-company networks will be constructed over the next decade, and AT&T rightly sees itself as the master builder. Among the possibilities:

- Inter-company traffic. Networks for on-line order entry, computer-to-computer billing, and funds and records transfer have immense potential to automate paper flow and affect many thousands of jobs.

- Network management. By putting intelligence in the network, Net 1 has the potential to eliminate many of the user's networking headaches, and poses AT&T's first direct threat to IBM's DP hegemony.

- Electronic mail (EM). If the price is right, terminal compatibility and store-and-forward features will give EM a boost.

- Application development. Cobol and a new application development tool are offered under the Vax VMS operating system.

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AMERICAN BELL AND NET 1 AT A GLANCE

American Bell -- $3 million in capital and $56 in assets; 1,000 employees. Another $568 million expected by 1985 to get Net/1 up and running. American Bell will handle all of AT&T's unregulated activities (unless other subsidiaries are formed) including: enhanced communications services; terminal and data processing equipment; and all other customer premises equipment. Packet-switched data transmission remains a regulated service and part of AT&T.

Top executives -- CEO, Salvatore Barbera, formerly Assistant VP and Director of Major Projects at AT&T; William Smith, formerly Director of Project Implementation for Long Lines, now in charge of American Bell's Business Operations; and Bartholomew Donahue, former Executive Director of the Data Communications Division at Bell Labs, now responsible for American Bell's R&D.

Advanced Information Systems/Net 1 -- Initially 17 service points (concentrators) expanding to 100 by 1984, and four nodes in major cities. Network nodes will be in N.Y.C., Chicago, Salt Lake City, and Somerset, N.J. Each node consists of several Vax 11/780s using the VMS operating system with IBM Series/1s as front ends. Nodes and service points will be linked by a packet network, most likely AT&T's BPSS (Bell Packet Switching Service).

- Terminals supported -- asynchronous contention mode (TTY and IBM 2741 type; asynchronous polled mode (such as IBM's 2740 model II); synchronous contention mode (IBM 2780, 3780, 3275 type); synchronous polled mode (IBM 3270-type, specifically 3271 and 3277 BSC). Full terminal functionality will be maintained. SDLC/SNA and X.25 will be added later.

- Host interfaces -- asynchronous contention; synchronous contention, and polled synchronous. SDLC/SNA and X.25 will be added later. Host interfaces are through terminal emulation.

- Initial applications -- data manipulation (code, protocol and speed conversion); application development; store-and-forward; program and data storage; data validation; network management; electronic mail.

- Transmission options -- interactive inquiry/response and one-way store-and-forward; maximum user speed 9.6kbs. Connections via either private line or dial-up.

- Redundancy -- back-up CPUs, alternate routing, layered software.

- Software -- subset of ANSI Cobol and a new Forms Definition Facility, a forms creation tool for increasing programmer productivity. Applications software will be left to users or third parties.

- Pricing -- based on usage. Monthly charges for private line ports range from $250 to $1,000 depending on speed; public dial-up ports range from $.07 to $.16 per minute. There are additional charges for use of computer facilities and for detailed usage reports. Bell notes that pricing may change before the service becomes available.

- Availability -- third quarter of 1983. A "controlled introduction" of field testing will begin shortly.

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What's in a name?

For a product that hasn't even been sold yet, Net 1 sure has gone through a lot of names. It started out as the Bell Data Network, but that contained the forbidden word "data," which caught too many eyes at the FCC. Then it was the Advanced Communications System, but "systems" was also a data processsing word, so it was changed to Advanced Communications Service. Now with the regulatory shackles loosened, AT&T has chosen the Advanced Information Systems/ Net 1, which has a data processing ring and implies other networks to follow.

After four years of waiting, many were surprised to see that Net 1 is almost identical to the original ACS filing in 1978. The emphasis is on "communications processing" to integrate equipment and manage growth. American Bell Inc. (ABI) says Net 1 will appeal to large and small businesses alike.

Net 1 is not a transmission facility, if the user doesn't want processing functions (protocol or speed conversion, store-and-forward, or timesharing), he doesn't want Net 1. In fact, Net 1 is not really even a network since it will use a common carrier packet net to carry its traffic. ABI maintains that it won't use the Bell Packet Switching Service (BPSS) unless it is the best deal, and the proposed BPSS rates are much higher than other packet nets.

ABI admits that Net 1 will not offer anything that isn't being done somewhere else already, but it says Net 1 will be the most complete offering of its kind and will offer an unmatched breadth of compatibility and services. AT&T boasts that 84% of the installed terminals will be able to use Net 1, and that full terminal functionality will be maintained.

Tymnet remains unfazed, saying that it can match the protocol conversion features, and that if the customer wants processing power or stored programs, he can get them from Tymshare. Tymnet makes the following distinction: if the customer uses his own or a third party's computer, it's a Tymnet job; if he uses Tymshare computers, he's a Tymshare customer; Net 1 merely puts similar services under one name. Tymnet adds that its prices are roughly 20% less than Net 1's, but that the higher the terminal speed (read 3270) the closer the two companies' prices become. About 20% of Tymnet traffic is 3270.

Who will bear the brunt?

In fact, remote processing services firms like Geisco and Tymshare may well be more affected by Net 1 than the pure packet switching providers. EDP/IR feels that Net 1 will have to supply a lot of processing services in order to be profitable. It won't prove economical for traditional packet applications such as credit authorization or data base inquiry. Value-added is the key to profitability; some 20% of Tymnet's business is from Tymshare customers; whereas Telenet, which offers no processing powers other than conversion and store-and-forward, has consistently lost money. The price competition for transmission services will stiffen when packet nets, other than AT&T's, are deregulated in January 1983 in accordance with Computer Inquiry II.

TEN LARGEST REMOTE* SERVICES VENDORS 1981	$M
Control Data Corp	$461
Geisco	427
Automatic Data Processing	253
Electronic Data Systems	205
Tymshare	182
McAuto	131
Shared Medical	125
United Information Systems	117
Computer Sciences Corp.	110
National CSS	98

*Figures for remote revenues only

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"The compatibility of a wide range of terminals will make it feasible to develop new intercompany data communications applications without having to replace existing terminals, procedures, and data formats." -- from ABI's press release.

In his press conference remarks, one of the few large scale applications mentioned by American Bell President Sal Barbera was on-line order entry between large retailers and their suppliers. EDP/IR feels that automating routine inter-corporate correspondence -- price lists, purchase orders, invoices, billing, etc. -- is typical of the type of business AT&T is counting on, and ABI's press kit was full of references to inter-company applications.

IBM is also very interested in this market, using the "inter-enterprise" label. At last February's Compcon show, Lewis M. Branscomb -- IBM vice president and chief scientist -- talked about "robust inter-enterprise nets," that link suppliers, distributors, banks and retail points-of-sale. In that speech he seemed to endorse the redundancy concept saying "highly efficient enterprises linked in real time to other enterprises must be resilient."

EDP/IR has espied Electronic Data Interchange (EDI) activity -- be it standards development, pilot projects, conference papers, or trade group hoopla -- in many major U.S. industries, with retailing, transportation, banking and pharmaceuticals among the leaders. But progress has been slow, with the usual stumbling blocks being standards, software, leadership, and commitment. Competitors rarely find cooperation easy, and perhaps only the airlines have truly succeeded in developing a true inter-corporate system. Some examples of possible inter-enterprise systems are given below.

- A prototype of an electronic purchase order (EPO) program has been running since 1979 between the M. O'Neil Co. (an Ohio department store), General Electric Information Services Co. (Geisco) and Haggar Company (slacks). O'Neil orders are sent to Geisco in a prescribed EPO format; Geisco then translates them into a language that Haggar computers can understand. The orders are stored at Geisco until Haggar requests them. O'Neil claims the system has cut delivery times from five to six weeks to five to six days, and accuracy has improved. A similar system is envisioned for the grocery industry.

- As far back as 1977, Michigan Bell was offering a mini-Net/1. Doctors across the state could transmit claims information to a Blue Cross/Blue Shield computer through a Michigan Bell switch which supported incompatible terminals.

- On the consumer side, ABI could receive consumer payments -- to large retailers, banks, credit card firms, or utilities -- over a videotex system, eliminating costly mail-based systems. The system would consolidate payment information at the node, and provide data to both banks and recipients. Paper versions of such "lockbox" services are now offered by both banks and service companies such as National Data Corp.; payments are mailed to the service group which processes them for the recipient. AT&T is very serious about videotex, much to the chagrin of the nation's newspapermen.

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LEGAL CONTROVERSIES AND THE BUREAUCRACY AT WORK

The general reaction of potential competitors is a fear of cross-subsidization. AT&T is building an entire packet network seemingly for ABI's use, and ABI has access to the best of AT&T's personnel, including a transfer of an unspecified number of Bell Labs employees. In fact some of ABI's workers today are actually AT&T employees with AT&T billing ABI for their use. Opponents see AT&T's Bell Packet Switching Service (BPSS) as a way to pass the network development costs over to Long Lines which will then charge ABI an access fee not fully reflective of costs. But then again, the proposed BPSS tariff rates are much higher than those for Telenet or Tymnet. Nothing that Judge Green or the Congress has to say is likely to effect the Net 1 services described so far.

The battle for communications policy-making authority has become a classic example of the fine line between bureaucratic entanglement and admirable system checks and balances. To help cut through the confusion, EDP/IR offers the following overview of the participants and their roles:

- The FCC -- In March of 1980, the FCC's Computer Inquiry II ruling deregulated everything besides basic transmission services. AT&T could enter deregulated markets through fully separate subsidiaries, but since AT&T was still forbidden to enter unregulated markets by the 1956 Consent Decree, its products would have to be tariffed, though the products of competitors would not. BPSS rates will also be tariffed because the FCC classifies AT&T as a "dominant carrier." The other packet nets will be deregulated in January 1983.

- The Justice Department -- On January 8, 1982, DOJ dismissed its seven-year antitrust suit vs. AT&T in return for an update to the 1956 Consent Decree. The proposed settlement allows AT&T to enter any and all unregulated markets, and says nothing about separate subsidiaries. The Justice decision puts more restrictions on the Bell Operating Companies than many in Congress find desirable.

- Judge Green -- Under the Tunney Act, public comments have been reviewed, and more information has been requested. There are differing opinions as to what the judge can do, but it will be hard for him to alter the settlement since he doesn't have the support of the DOJ, AT&T, or the FCC. Expect an approval, with some minor monitoring guidelines.

- H.R. 5158 -- The future of this bill should be known within the next few months. AT&T has pulled out all the stops in an effort to kill it since it would, among other things, make Long Lines a fully separate subsidiary, force Bell to license its patents, and keep it out of the electronic publishing business. It has urged its stockholders to write their congressmen, presented the testimony of many famous economists and received the support of its good friend the Department of Defense. Though H.R. 5158 has some considerable Congressional support, it is unlikely to pass in its present form.

- The Communications Act of 1934 -- If no other bills are passed, the 1934 Act will still be in effect; the bill, among other things, created the FCC and gave it regulatory powers, which are checked not by Congress, but by the D.C. Circuit Court of Appeals.

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U.S. TELECOM MARKET
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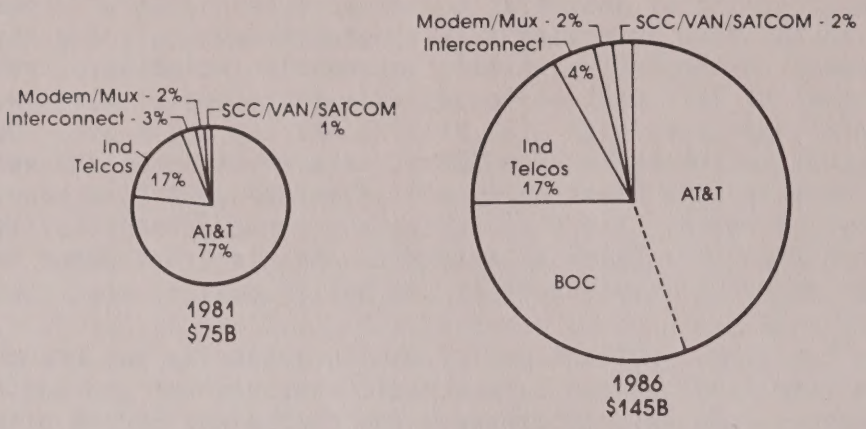

Definitions: SCC are Special Common Carriers like MCI or SPCC, VANs are Value Added Networks like Telenet or Tymnet; Interconnects sell PBXs; BOCs are Bell Operating Companies, and SATCOM is for domestic satellite communications.

Network management

> *"Dedicated data communications networks are difficult to expand or modify, due to the coordination required to deal with polling sequences, line loading, and response requirements. But with Net 1 customers are relieved of these problems of integrating new terminals and hosts computers into their system. Net 1 will take care of all link requirements for them."* -- from ABI press release.

Network management ranked second to inter-corporate traffic in ABI press kit emphasis. The company played upon two main themes: the lack of skilled datacom staff and the speed with which new datacom applications can be implemented. According to ABI, new terminals and applications can be added without affecting existing applications and terminal types can be changed without interfering with other terminals in the network. It also boasts that it can reduce the need for "additional communications equipment and facilities, software conversion, reprogramming, and operator training." Remote processing and packet switching firms make similar claims, but since AT&T is already a key partner in so many data networks, it may have a significant marketing edge.

Cash management is a good example of how Net 1's store-and-forward could operate a sophisticated dedicated network. Retail, grocery, and fast food chains, branch banks, gas stations, and other groups that collect funds at a large number of points want to have an easy way to consolidate information for head office decision-making. Net 1 could gather data from any machine, consolidate it at one of its nodes, then forward a single information package to headquarters with the report generating software stored at the ABI node.

Given the headaches of network management, if AT&T produces a convincing solution, it will find customers, many of whom are now IBM's. If ABI gets control of the user's network, it will be in position to sell whatever hardware is needed. Expect an attack on the IBM terminal base since, according to Tymnet, Ascii access to IBM hosts is one of its main markets; AT&T is known to have produced prototypes of advanced office terminals. ABI reports that Net 1 has already received a tremendous amount of interest from potential users.

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Between inter-company communication, protocol conversion, application development, and network management, Net 1 does address a substantial market, but none of these opportunities are restricted to ABI. Unless American Bell shows a savvy sales force, it won't dramatically change the market. Even AT&T can't snap its fingers and make things happen overnight. Net 1 will take several years to build and won't be in full swing until 1984. Tymnet estimates that the packet transmission market will be worth about $500 million/year by 1985; by then AT&T will have sunk $600 million into Net 1 and will need some $500 million/year to turn a profit; hence the need to sell lots of processing power.

Relations with IBM

The collision course between the two giants of the information industry, AT&T and IBM, continues on track. It is becoming increasingly apparent that the two companies are the mirror images of each other. AT&T with its mastery of communications, and new freedom to approach hardware and services, and IBM with its rule of computers and its new interest in both services and communications. AT&T, the regulated pursuing the unregulated, and IBM the unregulated, moving towards the regulated.

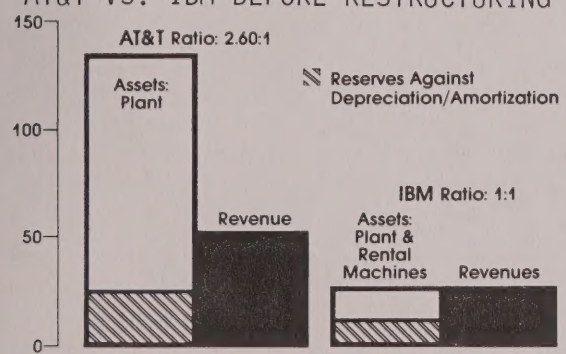
At the same time, there is still little competitive overlap in data communications. Satellite Business Systems and Net 1 are addressing very different markets. SBS originally intended to go after high speed computer-to-computer data transmission links for very large users, while Net 1 offers data manipulation services for its slow speed traffic. SBS is, however, finding most of its business is coming from voice traffic and slower speed multiplexed data. A size comparison is given below:

	Satellite Business Systems	American Bell**
1982 Funding	$600 million	$59 million
Funding by 1985	$1 billion*	$627 million
Number employees	1,500	1,000
1982 Revenues	$55 million*	0
Begins operations	March 1981	3Q 1983

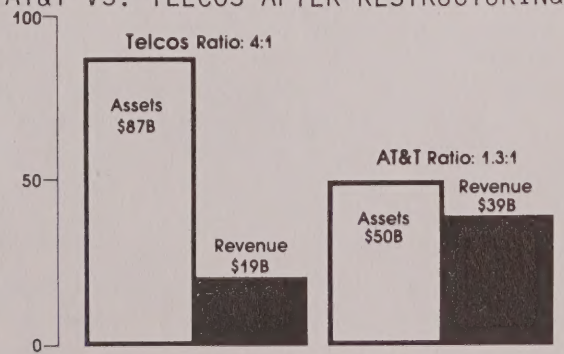
*Estimated SBS figures. **All figures provided by AT&T.

The two are a little closer on the services side. Both Net 1 and IBM's Information Network offer application development tools. But IBM's service is aimed at eventually selling more hardware and is primarily for its sophisticated customers. AT&T wants to build networking solutions, and is going after a wider base of users. IBM uses circuit switching, AT&T packet switching. Yet despite the many differences, the two companies are looking increasingly alike, and in an era of deregulation, few holds will be barred.

AT&T VS. IBM BEFORE RESTRUCTURING



AT&T VS. TELCOS AFTER RESTRUCTURING



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• STC GETS SATISFACTION FROM IBIS. In an unusual settlement, Storage Technology Corp. has agreed to drop its six month old suit against Ibis Systems, Inc. in exchange for Ibis promises not to hire certain STC employees for 30 months, and not to have certain ex-STC employees work on "specific types of product development." In addition, Ibis agreed to make a single cash payment to compensate for the hiring of 13 STC employees in late 1981. STC had accused Ibis of misappropriating trade secrets and charged the ex-employees of with breaching "their contractual and fiduciary duties to Storage Technology."

Ibis and its employees had denied the charges, and had even filed a countersuit charging STC with "unfair competition." Ibis plans to ship a 3380-compatible drive in late 1982; it will also build 1.25, 2.5, and 5 gigabyte SMD-type drives. The company recently completed a deal with Fee, Ltd. which will sell and service Ibis drives in the British Isles; the deal is estimated to be worth $9 million in the first year.

• CDC WRAPS UP CENTRONICS BAIL OUT DEAL. Under the newly completed terms, Control Data will hold a controlling 35% of Centronics, and NCR and ICL will hold 5% each. CDC has also installed Thomas Kamp, president of its Peripheral Products Division, as Centronics' Chairman, replacing Centronics founder Robert Howard. As part of the deal, Centronics acquired the printer business of Computer Peripherals, a joint venture between the three mainframers.

• TRILOGY FINDS JAPANESE OUTLET. The giant Sumitomo conglomerate plans to set up a join venture with I.C. Corporation to sell the high-end IBM compatible mainframes which Gene Amdahl's Trilogy plans to bring to market sometime in 1984. I.C. Corp. is a microprocessor software house in Tokyo that will handle the maintenance and software support side of the business. Sumitomo says that it expects to sell the machines mostly to banks and research institutions. the venture will be capitalized at a little over $1 million.

• DEC SETS UP FIRST ASIAN RESEARCH FACILITY. Over the next three or four years, Digital Equipment expects to have about 100 engineers working on hardware and software projects in Tokyo. Whether DEC will team up with a local Japanese firm to develop Kanji-based systems has yet to be decided.

• CIE SYSTEMS GRABS FIRST BIG OEM DEAL. The C. Itoh Electronics subsidiary will supply General Automation with $50 million worth of its Motorola 68000-based desktop over the next five years. The move is not surprising since CIE uses the Pro-IV software development tool also used by General Automation.

• POLAROID MOVES TO HINDER COUNTERFEITING OPERATIONS. With widespread counterfeiting of Apple Computers being reported from Asia, Polaroid may have a timely product with its optical identification strip. Called Polaproof, the strip is said to be impossible to duplicate, can be read by either a machine or the human eye, and costs pennies. It will also be used for records, tapes, jeans, tickets, etc. Counterfeit Apples are reportedly being sold for less than $500, indicating that desktop prices still have plenty of room to fall.

• APPLE/PRENTICE HALL TEAM UP FOR EDUCATION MARKET. The two companies will team up in the areas of software development, product demonstration, and training. Prentice Hall is the world's largest publisher of college textbooks.

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MOLLY UPTON, EDITOR JULY 6, 1982 ● VOL.18,NO.6 P.J. MCGOVERN, PUBLISHER

WHAT PRICE MICROCODE?
ALLEGED JAPANESE CRIMES SPREAD NEW DOUBTS OVER PCM INDUSTRY

The events beg the question. If a $15 billion high technology company like Hitachi and a massive conglomerate like Mitsubishi have to buy stolen information to keep pace with the technical developments at IBM, what chance does a Magnuson, IPL, or even Amdahl have in the long run? Though the international repercussions will grab most of the ink, the so-called "Japscam" or "Computergate" scandal may turn out to be one of the biggest PCM stories in years.

There are two ways of looking at the alleged illegalities. They are either yet another example of what a few months lead time can mean to a PCM, or they are new evidence that IBM's stepped up pace of new products and microcode updates threatens to leave the PCMs in the dust, forcing desperate measures.

Given the complications presented by IBM's forthcoming extended architecture and 3380/3880 I/O complex, EDP/IR is inclined to lean toward the latter view. The PCM industry has seen crises before, but this instance is particularly nettlesome since -- unlike the Itel or Magnuson debacles -- the charges strike at the PCMs technical capability. The PCMs, however, maintain that they can counter IBM's punches, confident that IBM can only hurt them at the expense of either itself (via low prices) or its users' software. Some thoughts:

- If it weren't for the Japanese, both National Advanced Systems and Amdahl might well be out of business, since both rely heavily on Japanese hardware.

- The European Economic Community suit against IBM is trying to force IBM to provide much the same information as Hitachi and Mitsubishi are accused of procuring.

- Given the small percent of Hitachi's revenues from PCM CPUs, EDP/IR wonders how strong its commitment to IBM-compatibility really is.

- Some companies have already frozen procurements of Japanese PCM machines. Government agencies are pondering similar actions.

- Apparently, the PCMs are finding IBM's dynamic channel feature the most difficult to replicate, not the 31-bit addressing itself.

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The Japanese position

JAPANESE PCM CONNECTIONS

Fujitsu	Hitachi	Mitsubishi
Amdahl	National Advanced Systems	IPL
Siemens	Olivetti	
ICL	BASF	
TRW		

Japanese vendors have long been aware of the difficulty of maintaining strict IBM compatibility. Both Hitachi and Fujitsu offer their own versions of IBM's operating systems and and they sell relatively few PCM systems in the Japanese market. The machines they do sell are nearly compatible, and Fujitsu claims that it is an easy task for third-party software vendors to rewrite IBM programs for its machines. The PCM machines are mostly sold internationally; the PCM CPUs sold by NAS, Olivetti, BASF, and Hitachi are identical.

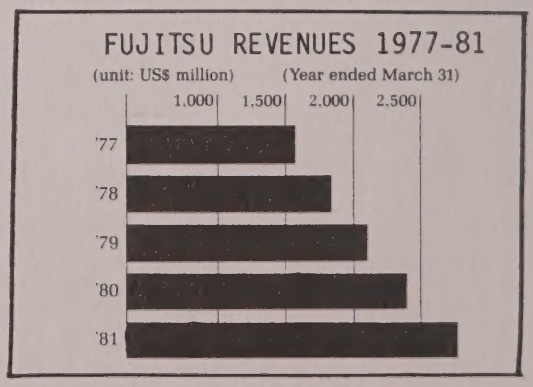
Both Hitachi and Fujitsu have often said that they want to be total system suppliers not just PCMs, and Hitachi has questioned the long term profitability of the PCM business. More than anything else, both companies want to maintain their good name; Hitachi has a reputation for being one of Japan's best managed companies, and it has always taken great care in building its OEM relations. If the IBM-compatible challenge involves any risk to its image, the possibility of it dropping out is not to be excluded; its agreement with NAS is, however, for the "long term," according to NAS.

In statements made in Japan, Hitachi not surprisingly has reconfirmed its intention to compete in the IBM marketplace; it said that it will match IBM's /XA machine despite possible handicaps in restaffing their R&D forces (the indictments could tie up some key people). Sources in Japan say that Hitachi will introduce an /XA machine that concurrently runs 24 and 31-bit programs, but that it may not hit the market for take 20 to 30 months after IBM delivers /XA in early 1983. But NAS has already promised /XA within a year of IBM's first delivery, and says Hitachi will deliver.

Fujitsu and Amdahl

Although the scandal has not touched Fujitsu, it has called new attention to its relation with Amdahl. Amdahl's 580 series marks a significant architectural departure from Fujitsu's 380 series, but Amdahl is still dependent upon Fujitsu for custom semiconductors and $54 million worth of "mainframe subassemblies." Despite reports of engineering and software differences, the companies maintain mutual interests. Amdahl's 4705 front end processor, based on Fujitsu's 2860B, has been marketed successfully, and as the U.S. company ponders the potentially lucrative peripheral business, Fujitsu looms as a natural supplier. Fujitsu owns some 32% of Amdahl's stock; so what's good for Amdahl is good for Fujitsu, but Fujitsu's link with TRW suggests that it will not rely solely on Amdahl for U.S. sales.

Fujitsu has thus far not made any public comment on the scandal. In mid-June it announced three models of its 380 series that will include an IBM-compatible 31-bit architecture. It also said that its version of /XA will be out a year after IBM's and will allow users to run existing applications without any conversion. The company claims it has been anticipating the 31-bit move since the early 1970s.



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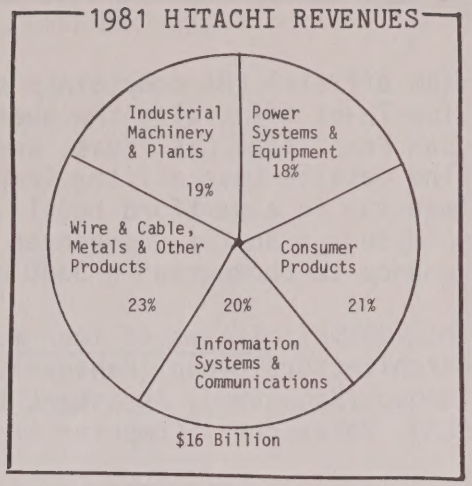
EDP/IR believes that IBM views Hitachi as a greater long term threat than it does Fujitsu, despite the fact that Fujitsu is Japan's number 1 mainframer and has done well in overseas markets such as Australia and Brazil. With nearly five times the corporate revenue of Fujitsu and a potent merchant semiconductor business, Hitachi has the greater technological resources, especially since it can leverage some of the investment off its consumer products division. As the chart below shows, the computer revenues of the top ten Japanese suppliers equal less than a third of IBM's annual revenues, and four of the ten companies are U.S. subsidiaries.



Mitsubishi's dilemma

There is some reason to believe that given the ongoing trade in industry secrets that IBM may well have had its choice as to who it "set up." The FBI affidavits make frequent references to materials already procured through other sources (see sidebar on page 4). Why Mitsubishi got stung is somewhat of a mystery. Back in 1980, Mitsubishi announced its intention to bring out a medium to large scale PCM machine (most likely in the 4300 range) in October of 1983 as a replacement for its Melcom Cosmo series; that machine may be delayed until early 1984. A 5-9 MIP machine is also said to be under development.

Mitsubishi was said to be taking a distributed data processing approach for use mainly in Japan by its many affiliated corporations especially banks, which have been successfully raided by Hitachi, Fujitsu, and IBM Japan. Mitsubishi has just completed a technology agreement with IPL that could conceivably lead to Mitsubishi-built machines or subassemblies being sold in the U.S., although no such plans have been announced.

The company had planned on using a 24-bit architecture, but it now thinks that IBM intends to push its 31-bit architecture down into the 4300s (probably 4341s only). Thus far the company has not commented on any plans for 31-bit machines. Mitsubishi is accused of illegally procuring 4300 secrets.

TOP TEN COMPUTER VENDORS IN JAPAN (figures in $ millions)*

Ranking 1981	Company	Computer Revenues 1981	Computer Revenues 1980	%	Computer Revenues as % of total 1981	Computer Revenues as % of total 1980
1	Fujitsu	$1,974	$1,661	19	68%	66%
2	IBM Japan	1,865	1,471	27	100	100
3	NEC	1,424	1,124	27	31	29
4	Hitachi	1,252	1,087	15	14	13
5	OKI	474	410	16	51	51
6	Toshiba	437	358	22	5	5
7	Nippon Univac	395	342	15	100	100
8	Mitsubishi	391	333	17	7	6
9	Burroughs Ltd.	249	220	13	100	100
10	NCR Japan	216	210	3	71	67
Total		8,678	7,215	20	26	24

* Figures include worldwide revenues of Japanese-based suppliers.

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THE CASE, ACCORDING TO THE FBI COMPLAINTS

The official FBI complaints show that this was not a one shot entrapment of low level officials; the events spanned six months of meetings in Honolulu, San Francisco, Las Vegas, and Hartford, along with lots of calls to Japan. The details have all the trappings of a spy thriller with an alleged 5:00 A.M. meeting in a Hartford hotel lobby, a parking lot bribery, and an Hitachi employee and an FBI undercover agent hiding in a darkened office waiting for a chance to photograph a 3380 drive. EDP/IR offers the brief summary below:

MITSUBISHI: Titles of four men named in FBI complaint: Manager of Computer Architecture Group (Kanagawa, Japan); Deputy Manager Software Development Group (Kanagawa); Assistant to the President, Mitsubishi America (Compton, CA); Researcher, Computer Architecture Group (Kanagawa).

Materials sought: 4300 and 3081 chips; design details and source microcode for 3880 controllers; tapes of diagnostic source code for 370s and 4300s. Diagnostics included: ST/4300, OLTSEP, NST, YLSEP, FRIEND, and SOSP. $26,000 spent, another $75,000 offered. 24 meetings and phone calls with FBI over six months.

HITACHI: Titles of some of the 13 men named in FBI complaint: General Manager of Kanagawa works (CPUs); Manager, Computer Development (Kanagawa); Senior Engineer, Computer Product Planning (Kanagawa); Manager, Disk Storage Engineering (Odawara); Manager Disk Design (Odawara); Section Manager, System Programming (Yokahama); Senior Engineer, Product Planning (Yokahama); Engineer, Sales and Service, Hitachi America; Programmer, Hitachi America.

Materials sought: 3081 design workbooks; source microcode tapes of 3081 test/maintenance programs and 3033 Extended features; 3380 components, maintenance information, and Automated Logic Diagrams (ADLs); source microcode and ADLs for 3880; tapes of source microcode for MVS/SP version 2 (MVS/XA). A thermal conduction module (TCM). Total payments $622,000. 75 meetings and phone calls with FBI over seven months. Below are a few quotes from the Hitachi affidavit:

- He (Hayashi) gave Garretson (FBI agent) a list of the volumes already in the hands of Hitachi, and those which Hitachi desired.
- Hayashi said they would have trouble paying in cash, since such payment was indiscreet ... they usually used a tunnel company to make payments.
- He (Naruse) said that he was from Hitachi and that if there was any kind of trouble (in viewing the 3380), it's real trouble for Hitachi.
- I (Hayashi) have destroyed your (Garretson) letter. Please destroy every (sic) my letters after you recognize the essence.
- He (Hayashi) said (the) software (division) had managed to obtain some of the source microcode for the MVS/SP version 2 from another source.
- When asked how they would get the items through customs, Hayashi said that he would have Yoshida prepare phony invoices, identifying the TCM board as an engineering sample ... they would handcarry the tapes and documents.
- Ishida said that the NST program could be found at IBM, Poughkeepsie, in Department B44. (From the Mitsubishi case.)

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JAPANESE COMPANIES RANKED BY 1980 R&D EXPENDITURES*

Company	R&D Expenditures ($millions)	Percent of Net sales
1. Hitachi Ltd.	466	5.8%
2. Toshiba Corp.	325	4.8%
3. Matsushita Electric Co.	236	2.9%
4. Nippon Electric Co. (NEC)	203	6.0%
5. Mitsubishi	203	4.0%
6. Sony Corp.	155	7.0%
7. Fujitsu	144	6.1%

*Source: Nihon Keizai Shimbun. Figures include all corporate R&D, not just for computer operations.

Worldwide speculations

The alleged offenses have caused concern at the highest levels of government, and not just because of the possible effects on the U.S. and Japan's already strained trade relations. The CIA has increased its efforts to monitor technology transfers and thefts, and action on the international mainframe front always draws the attention of intelligence agencies.

The Japanese have made it clear that they expect computers to become a major part of their economy. From what can be gleaned from the details of the fifth generation computer project, a break with IBM compatibility is envisioned for the machines expected to arrive in the 1990s. EDP/IR is convinced that the Japanese do not believe their future lies with copying IBM, a strategy not without merit since penetrating the PCM market has proven very difficult.

In addition to Japan, the world's second largest computer market, the third world represents a large potential market not already locked up in IBM software investment. Fujitsu is pushing hard in South America, and everyone is keeping a very close watch over the potentially huge Chinese market. The China case is particularly interesting because U.S. security interests want to control and monitor China's access to modern technology; ditto for the Soviet Union, another largely untapped market.

The Soviets, by the way, view the whole affair as an "unseemly operation" designed to convince the American people of the need for greater domestic security. (The arrests did in fact coincide with Congressional hearings into the appropriateness of sting activities). They are also trying to draw parallels to the U.S. decision to hold back key turbine technology in order to stop the construction of a joint European/Soviet gas pipeline.

Reinforcing old stereotypes

One of the tragedies of the incident is that it has aroused jingoistic prejudices full of outdated Japanese stereotypes. It is also serving as an outlet for pent-up economic frustrations. Japanese success in the computer industry has come against great odds, involving a lot more than mere copying, and no one incident can take that away. Business with U.S. firms will continue since the growing international network of joint development and component interdependencies is not easily broken. Even IBM has said it does not expect the events to affect its dealings with Japanese suppliers, Hitachi included.

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The reaction in Japan

In Japan, entrapment techniques are only implemented when narcotics are involved, and the Japanese media have harshly criticized the FBI tactics, seeing them as part of deteriorating relations between the two nations. Both Hitachi and Mitsubishi have vigorously denied any wrongdoing and say they will refuse to extradite employees to the U.S., unless their government asks them.

Among the Japanese user community, however, the reaction has been calm. As in the U.S. users are not clamoring loudly for /XA -- possibility because its full value has yet to be explained. Large Japanese users are known to be very conservative and would prefer to see /XA in action before making a commitment.

Thus many in Japan believe that the Japanese vendors have plenty of time in which to master /XA even after IBM's initial shipments. As in the states the PCMs believe that investment in user software will prevent any unmatchable changes. The general feeling is that as things look now Hitachi could conceivably fail to deliver /XA until 1986 and still not be in real danger of losing its customer base to Fujitsu or IBM. But if they fail to match IBM by then or if IBM succeeds in pushing its shipment curve to the left (see chart), then the Hitachi base might well be in trouble.

There is also speculation that if the PCMs continue to keep pace, IBM might take more drastic measures such as putting its operating system features into a special black box. But the general feeling is that this would require an enormous investment by IBM and would be fruitless from the user's point-of-view. In fact, there is a growing feeling that IBM is expending too much energy into competing with the PCMs and not enough in meeting user needs.

TIME LAGS BETWEEN IBM SHIPMENTS AND PCM SHIPMENTS IN JAPAN
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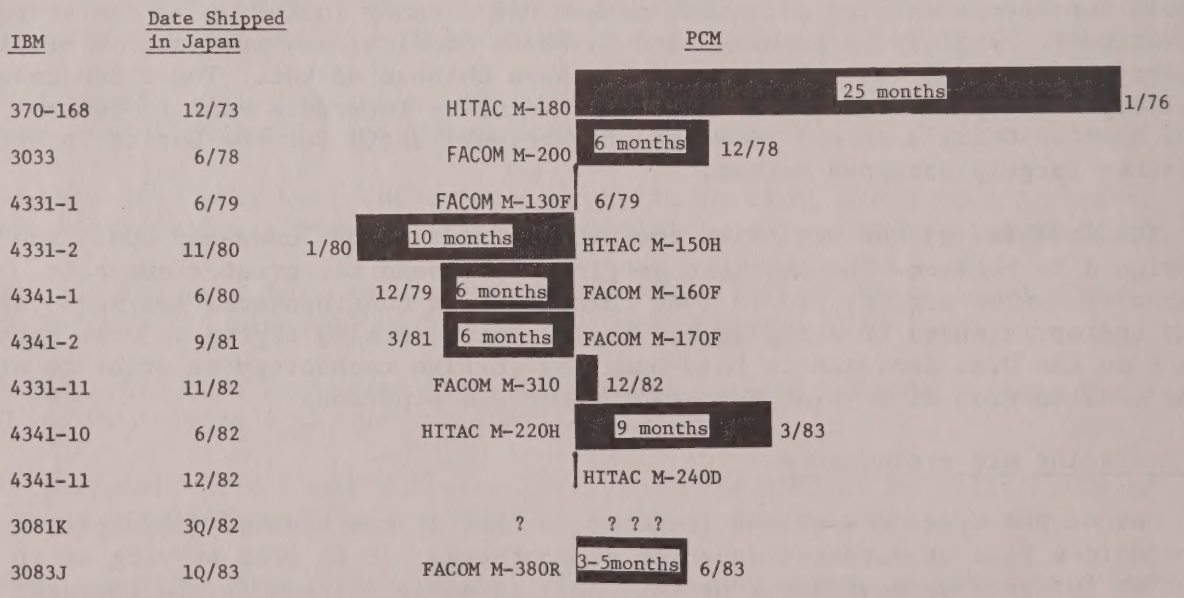

Note: Japanese PCMs have not yet announced 31-bit architecture machines which will compete with IBM 3081K.

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USED 3033 TRADING BECOMES BRISK: IBM STEPS UP DISCOUNTING ACTIVITY

The market seems confused. On the one hand IBM is saying that customers are taking all the 3081s it can build, while on the other third party lessors are scrambling to buy up all the cheap 3033s they can find.

In the face of 3081 price tags of more than $4 million and today's high interest rates, one might expect that some customers would delay 3081 deliveries by picking up used 3033s that are selling at only about 35% of list -- or about $140,000/ MIP, compared to over $300,000/MIP for a new 3081K or 4341. Lessors reportedly are finding all the business they can handle, with most customers opting for short-term leases.

But at its recent stockholders meeting, IBM CEO John Opel adamantly maintained that orders and deliveries of 3081s remain "very strong," saying that he is "baffled" by reports of customer delays in taking 3081s. According to Opel, IBM is building more 3081s than it originally anticipated. This could explain why 3081 lead times are down to a few weeks, and why IBM is calling many of its customers asking them to take early 3081 d 1 very.

IBM is also getting aggressive in the 3033 market. EDP/IR has learned of at least one case of IBM's offering steep discounts on 3033s. When asked about this, an IBM spokesman said that although IBM does not have a formal volume purchase plan for the 3033, it does "in certain unique cases" offer discounts. When asked to describe such circumstances, the spokesman had no comment.

Currently only the 3033S is in new production, other members of the family are in "limited new," which means that some new machines are built (when the customer needs the investment tax credit) but "reconstituted" machines are also sold. In the past, IBM has sold its used machines at the full retail price. Were it to sell these machines at used market prices, it would be going head-to-head with the third party lessors. There are reports that for the first time IBM salesmen are actually developing lessor contacts, at one time the most heinous of sins.

EDP/IR believes that the market is in a slight disequilibria with 3033 prices artificially low; because of the strong demand, used 3033 prices may actually rise slightly over the next few months, with conditions settling down when the 3083s start arriving in the first quarter of 1983.

Trend toward volume discounting

Volume discounting is definitely on the upswing at IBM. What started with the value-added remarketer program for the Series/1 has now expanded to include 3350 disks, 4300s, and a stepped-up accrual policy for 3270s. Now that IBM is shipping 3380s in quantity (the company says over 1,500 have been shipped so far), it is trying to unload lots of 3350s.

Buyers of 50 or more 3350 drives can get a 30% discount, and discounts of from 5% to 25% are available for buyers of from four to 49 3350s. The 3270 accrual policy looks like a way to convert the lease base to purchase, hinting at a new terminal line to follow; it may also be designed to keep customers from jumping to the competition. 4300 discounts remain in the six to nine percent range, and there are currently no formal discounts on 3083s, or 3081s.

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• PCM 3380s ON THE WAY. After Control Data showed its version of IBM's 3380 disk at NCC, both Storage Technology and Memorex apparently felt compelled to tell their story. STC says that is accepting orders for its 8380 as well as its 3370-compatible 8370 fixed block architecture drive. First shipments of the 8370 will be in early 1983; initial 8380 shipments are scheduled for the first quarter of 1983, but production shipments won't begin until early in the third quarter. The STC drives feature extensive use of microprocessors and remote diagnostics. The 571 MB 8370 is priced from $28,960 to $56,510 depending on model, and the 2.5 gigabyte 8380 ranges between $82,555 and $117,300.

Memorex is still wavering a bit. It has announced that its 3380-compatible 3680 is being tested internally and will go to customer test sites early in 1983. When this program is completed, the company will announce firm shipment dates and prices. Memorex also said that it will make a version of the 3680 available to OEMs. IBM, meanwhile announced at its recent stockholders meeting that it has already installed over 1,500 3380 drives since it began shipments last October. (For details of the CDC 3380-type disk see EDP/IR Vol.18, No.4.)

• BELL LABS TELLS OF NEW JOSEPHSON JUNCTION CIRCUIT, GRAPHICS TERMINAL. Bell claims that their 600 switch chip is the most complex Josephson circuit built since Bell received the first Josephson Junction patent in 1966. AT&T commented that it believes that Josephson circuits will be the heart of tomorrow's supercomputers, although this particular chip is aimed at more efficient color television transmission; Bell handles much of the nation's TV traffic. AT&T has also introduced a $34,000 graphics terminal that will allow greatly improved graphics to be composed for its future videotex system. Appealing mostly to advertisers, the system can produced 65,000 different color shades, making it possible to virtually reproduce drawings.

• MSA AND HONEYWELL, IBM AND ANACOMP TEAM UP. The hardware giants continue to try to snuggle up to the purveyors of software and services. Honeywell and MSA will cooperate on the development and marketing of MSA's financial, cash management, and human resource software packages for users of Honeywell's DPS 8, Level 66, and Level 68 systems. Anacomp has announced that it has agreed to offer IBM financial hardware as part of the Anacomp Customer Service Automation (CSA) program for advanced large scale banking automation. Anacomp hopes to become a one-stop provider of banking needs, hardware, software, training, consulting, and services.

• IBM AND SONY ANNOUNCED VIDEOTEX HARDWARE. The IBM Series/1 Videotex System (SVS/1) is a licensed program that enables up to 24 concurrent users to link either IBM personal computers equipped with special adapters or videotex terminals to a Series/1 for applications such as electronic mail and graphics. In its use of menus and a few basic commands, the system is similar in function to the British Prestel system, except that it creates its images through a mosaic of small rectangular elements. First customer shipments are scheduled for December of 1982, with a one-time software license of $10,000. Since SVS/1 runs under the EDX operating system, videotex applications can run along side of traditional Series/1 DP tasks. At Videotex '82 held recently in N.Y.C., Sony was for the first time showing a variety of videotex products including; Trinitron-based monitors, and black and white and color printers. Sony has been involved with videotex in the U.K. since 1979.

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REVIEW & FORECAST
Part I

"The Gray Sheet"

EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

MOLLY UPTON, EDITOR JUNE 28, 1982 ● VOL.18,NO.5 P.J. MCGOVERN, PUBLISHER

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DESKTOP SALES KNOW NO BOUNDS, JOIN MINIS AND WEAK ECONOMY TO GANG UP ON SMALL BUSINESS MARKET

Although both 1981 and 1982 have been dominated by the heady success and media attention given to desktop computers, the story has had its dark side as well. The price/performance and efficient distribution of today's desktops, coupled with a glum economy and falling minicomputer prices, are quickly deflating the once robust market for small business computers.

Indeed in 1981 the value of U.S. desktop shipments surpassed that of small business computers (SBCs); 1982 will show the same result for the worldwide market. Such is the difference in growth rates that by 1983, the value of the worldwide installed base of desktops will exceed that of SBCs, a remarkable turnaround given the nearly 3:1 SBC advantage held as recently as 1980.

International Data Corporation, publisher of EDP/IR, estimates that the value of worldwide desktop shipments will grow at 43.5% from $3 billion in 1981 to $18.3 billion in 1986. Small business computers, on the other hand, will grow at a compound rate of just 9.5%, from $3.4 billion in 1981 to $5.3 billion by 1986. Together the value of the worldwide desktop and SBC markets grew 32% over 1980, and will increase at a compound rate of 29.9% from 1981-1986, from $6.4 billion to $23.6 billion. Among some of the key trends:

- The value of 1981 U.S. SBC shipments remained flat at 1980 levels, reflecting the weak economy and a decline in average system cost. U.S. desktop shipment value was up 78% in 1981.
- The giants of the industry are making their moves. IBM and Xerox jumped in 1981; Wang and DEC have followed in 1982.
- Over two-thirds of all U.S. manufacturer's 1981 desktop shipments went to the U.S. market; for SBCs the figure was nearly 60%.
- Japanese vendors have confined their efforts to international markets, although their U.S. presence is now beginning to increase.

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VALUE OF WORLDWIDE SHIPMENTS -- DESKTOP AND SMALL BUSINESS COMPUTERS
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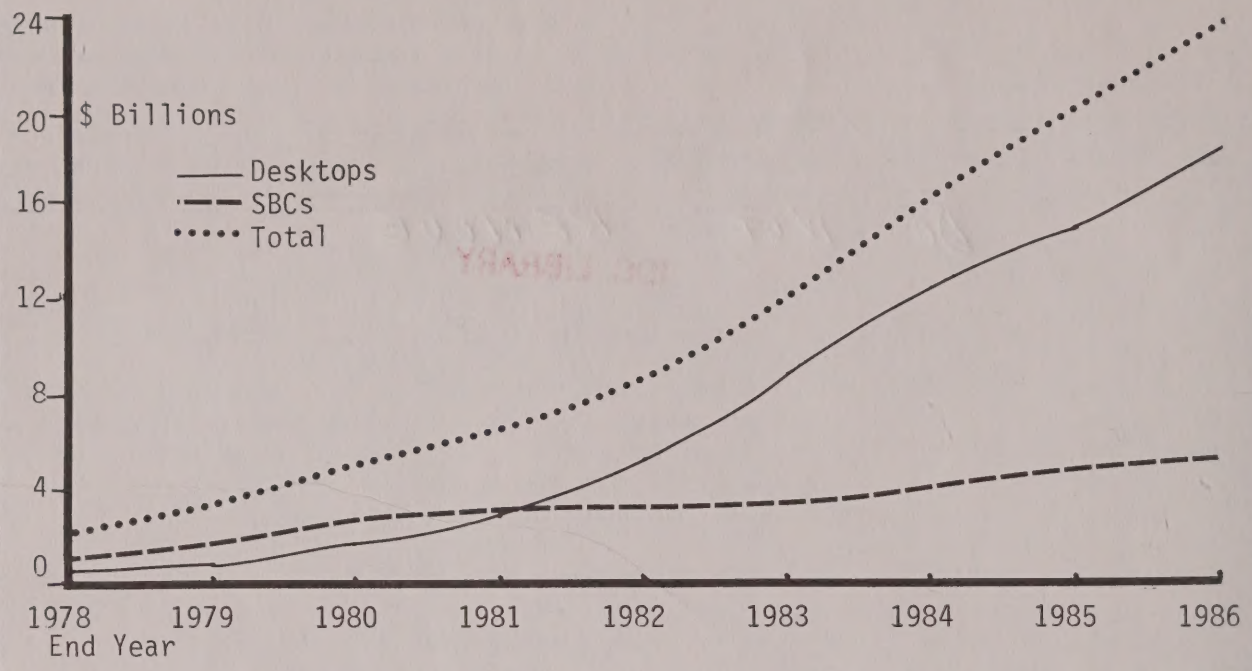

IDC has made substantial revisions in both its desktop and SBC forecasts. High activity in the business/professional and home market have upped desktop estimates; whereas desktop and mini competition and declining average system values have reduced expectations for SBCs.

The move to 16-bit desktops

Whereas 1980 and the early part of 1981 were characterized by scads of Z80 based desktops running CP/M, 1982 has been marked by the push to 16- and 16/32 bit systems. One current fad is for a desktop to have co-processors -- an 8-bit CPU that handles current CP/M applications and a 16- or 16/32 bit CPU that will prove more handy when 16-bit applications are readily available. The implementation of CP/M by major manufacturers such as Hewlett-Packard and Xerox has strengthened its position as a de facto 8-bit desktop standard.

Desktop operating system software generally falls into three camps: CP/M for the 8-bit; CP/M-86 and MS-DOS for the Intel 8088 and 8086-based units, and Unix for the Motorola 68000, which is dubbed a 16/32-bit system. Thus far, the Intel group has won the large vendors -- IBM, Burroughs, Wang, and NCR -- whereas the 68000 has been the favorite of many start ups. DEC, Honey- well, and Data General are among those taking their minicomputer architectures down to the desktop level, leveraging software investment, and preparing for the day when the desktop replaces the traditional low-end mini.

The business of system software for desktops and some small business computers is growing by leaps and bounds. Microsoft, known for its compilers, and Digital Research, licenser of CP/M, had 1981 system software package revenues of $14- and $11 million, respectively, and rank among the top five independent suppliers of system software, according to IDC. Digital Research tied for the top spot in terms of 1981 operating system revenues, along with Western Electric, licenser of Unix, while Microsoft took top honors in the

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U.S DESKTOP MARKET BY UNIT SHIPMENTS AND APPLICATION
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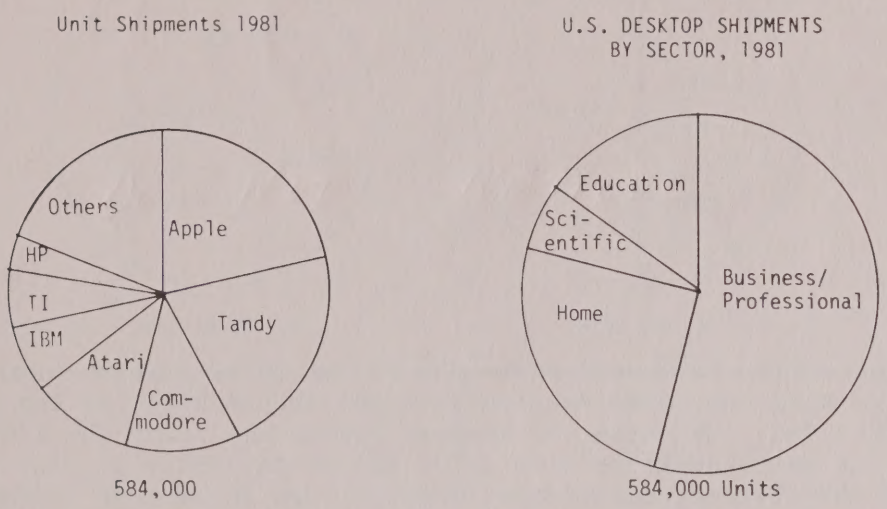

packaged compiler/assembler category among independent suppliers. An important side benefit is that the focus on just a few microprocessors and a few operating systems is hastening the day of widespread desktop software compatibility.

Market definitions

16-bit microprocessors have become important to both desktops and SBCs. This has led to to an overlap in IDC's traditional market definitions. IDC defines desktop computers as being microprocessor based, including their own power supply and enclosure, and capable of attaching peripherals; they have a minimum of 4K of memory, are programmable in a high level language and are priced from less than $1,000 to up to $15,000. SBC's have at least 4K of memory, are configured with peripherals and applications software, and are targeted at business applications. Prices generally run between $20,000 and $100,000. Given these definitions, the obvious gray area is the $15,000-$20,000 range, with systems by Altos and Wicat being typical examples.

By value, the fastest growing desktop sectors in terms of worldwide shipment rates between 1981 and 1986 are: business/professional, 51%; home/hobby, 40%; scientific, 16%; and educational, 11%. The rates in the U.S. are 54%, 42%, 15%, and 12% respectively. Since the U.S. market is growing faster than the international market (47% to 33%), the U.S. manufacturer's share of the value of worldwide shipments will increase from 68% in 1981 to 78% by 1986.

In terms of units installed in the U.S., Tandy still leads the pack with 29%, down from 35% in 1980, followed by Apple, Commodore, and Atari. Despite shipping its personal computer for only three months and its Datamaster for five months, IBM upped its share to 6.9%, compared to the 3.3% its 5100 series had in 1980. As for 1982, Commodore, Tandy, Atari, and Texas Instruments say that this will be a big year for the home with a boom in systems in the $400 to $800 range. Commodore continues to make hay in Europe.

Despite the presence of today's market leaders and the entrance of the industry's giants, the desktop arena continues to attract swarms of new ventures.

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1981 U.S. SBC MARKET, SEGMENTATION BY UNITS AND VALUE
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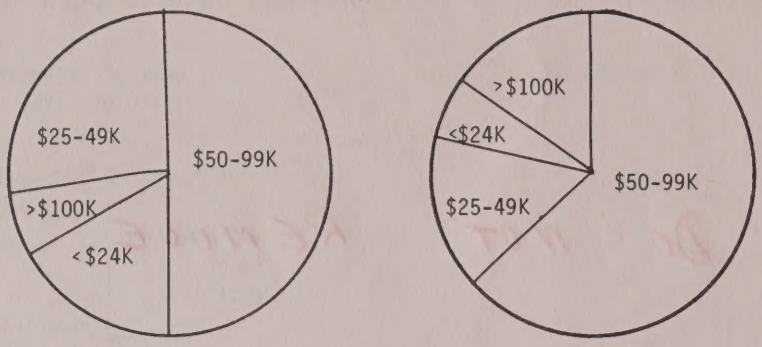

40,800 Units $1,980 Million

IDC counts some 92 companies selling desktops in the U.S.; if the international market is included, the number of vendors approaches 150. The list of companies trying to marry desktops with 5.25" Winchester disks is also lengthening. Yet despite the obvious competition, vendors such as Fortune Systems, Grid, and Convergent Technologies, have had no trouble getting financing and gaining market momentum; less secure perhaps are the numerous Z80 system vendors.

Distribution is also becoming a key factor as vendors search for the right mix of direct sales, distributors, and retail outlets. Vendors must simultaneously battle for retail shelf space and struggle for pricing consistency; to appease its dealers, Apple had to raise the prices it charged Computerland, damaging its valuable tie to the 200 store chain.

Small business market squeezed by economy

Numerous pressures are working against the small business computer market. With prices in the $20,000 to $100,000 range, SBCs are running up against ever more powerful desktops as well as sharply falling minicomputer prices with DEC's new baby Vax 11/730 being a prime example. The SBC customer base faces the highest rate of bankruptcies since the 1930s and persistent high interest rates continue to force buyers to postpone new purchases and upgrades.

At the same time, more is being asked of SBC vendors; there is new demand for office automation features as well as clearly defined upgrade paths. The cost of traditional strengths such as documentation and support is rising, but system prices must fall to meet the demands of competition. Most SBC vendors are concentrating on the low and middle half of the market because it offers the widest customer base and the possibility for future upgrades. Emphasis on hard disks, tape back-up and service must offset the lower costs of desktops which are often oversold and may fail to live up to many small business tasks.

The unexciting market numbers are also somewhat of a definitional creation. IBM's System/34 constitutes 25% of the installed U.S. SBC base, and 35% of the installed value. Many of these S/34 users are migrating to S/38s which IDC classifies as a general purpose machine; thus the actual SBC growth is somewhat understated. Since many S/34 users do not want to go through the difficult conversion to the S/38, IDC expects a follow on to the S/34 (S/36?) by the end of 1982; it will be classified as an SBC and give the market a mild boost in the 1983 and 1984 timeframe.

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SMALL BUSINESS COMPUTER MARKET -- U.S.-BASED MANUFACTURERS[a]

	Number of Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1976	22,200	39,000	870	1.6
1977	33,100	72,100	1,270	2.8
1978	43,200	113,800	1,850	4.6
1979	56,000	165,400	2,640	7.1
1980	64,100	224,700	3,110	10.0
1981	68,700	287,500	3,370	13.1
1982	77,800	356,800	3,580	16.4
1983	87,900	433,200	3,860	19.7
1984	99,900	518,200	4,390	23.6
1985	112,600	612,100	4,840	27.6
1986	126,000	715,200	5,300	31.8
		UNITED STATES		
1976	14,600	27,000	570	1.1
1977	21,900	48,900	840	1.9
1978	26,400	73,800	1,140	3.0
1979	31,400	101,500	1,530	4.4
1980	38,200	135,900	1,980	6.2
1981	40,800	172,600	1,980	8.0
1982	45,500	212,900	2,090	9.9
1983	51,900	258,300	2,280	11.9
1984	58,900	309,200	2,590	14.2
1985	66,300	365,800	2,850	16.6
1986	74,200	428,400	3,120	19.2
		INTERNATIONAL		
1976	7,600	12,000	300	0.5
1977	11,200	23,200	430	0.9
1978	16,800	40,000	710	1.6
1979	24,600	63,900	1,110	2.7
1980	25,900	88,800	1,130	3.8
1981	27,900	114,900	1,390	5.1
1982	32,300	143,900	1,490	6.5
1983	36,000	174,900	1,580	7.8
1984	41,000	209,000	1,800	9.4
1985	46,300	246,300	1,990	11.0
1986	51,800	286,800	2,180	12.6

a International Manufacturers with U.S.-based sales offices are counted in the U.S totals, but not international.

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DESKTOP COMPUTER MARKET -- U.S.-BASED MANUFACTURERS[a]

	Number of Systems Shipped	Cumulative Number In Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1976	9,000	16,000	128	0.2
1977	34,000	50,000	244	0.5
1978	163,000	213,000	562	1.1
1979	277,000	490,000	1,036	2.0
1980	454,000	944,000	1,779	3.7
1981	819,000	1,763,000	3,006	6.8
1982	1,520,000	3,283,000	5,372	12.1
1983	2,533,000	5,816,000	8,744	20.9
1984	3,636,000	9,452,000	12,364	33.3
1985	4,552,000	14,004,000	15,481	48.7
1986	5,434,000	19,438,000	18,286	67.0
		UNITED STATES		
1976	4,000	8,000	59	0.1
1977	25,000	33,000	168	0.3
1978	128,000	161,000	397	0.7
1979	184,000	345,000	668	1.3
1980	326,000	671,000	1,142	2.4
1981	584,000	1,255,000	2,035	4.5
1982	1,129,000	2,384,000	3,869	8.3
1983	1,938,000	4,322,000	6,685	15.0
1984	2,794,000	7,116,000	9,635	24.7
1985	3,463,000	10,579,000	12,077	36.7
1986	4,082,000	14,661,000	14,218	50.9
		INTERNATIONAL		
1976	5,000	8,000	69	0.1
1977	9,000	17,000	76	0.2
1978	35,000	52,000	165	0.4
1979	93,000	145,000	368	0.7
1980	128,000	273,000	637	1.3
1981	235,000	508,000	971	2.3
1982	397,000	899,000	1,503	3.8
1983	595,000	1,494,000	2,059	5.9
1984	842,000	2,336,000	2,729	8.6
1985	1,089,000	3,425,000	3,404	12.0
1986	1,352,000	4,777,000	4,068	16.1

[a] International Manufacturers with U.S.-based sales offices are counted in the U.S totals, but not international.

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SMALL BUSINESS COMPUTER CENSUS

The categorization of certain computers as "small business computers" is based on marketplace definitions as perceived by IDC. SBCs are those small general-purpose computers marketed to smaller businesses, first-time users, and increasingly to small units of large organizations. They include offerings from the major mainframers (such as IBM's System/32 and 34); products such as DEC's Datasystem/300 from the minimakers, but aimed at commercial first-time users; equipment from firms (such as Qantel) that manufacture only SBCs; and products from companies that market systems assembled from others' minicomputers (i.e., systems houses).

SMALL BUSINESS COMPUTER CENSUS AS OF JANUARY 1, 1982

Name of Manufacturer	Computer Model	Processor Model	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Advanced Information Design*	System 3000	Interdata X/16		24	39	03/75	41	0	41	X
A.M. Jacquard Systems	J100	J100		14	46	08/75	1,620	1,200	2,820	50
Anderson Jacobson*	1400	AJ 1400	a	16	22	01/70	260	15	275	X
	1520 Series	AJ 1500		19	21	07/77	200	25	225	X
	1560 Series	AJ 1500		30	35	07/77	60	3	63	X
						TOTAL	520	43	563	
Applied Computer Systems*	Smart Alec	8080-A		12	13	01/77	47	17	64	X
Applied Data Communications	Event	Event 2000		13	20	02/77	156	12	168	X
	Clinic 2	Event 2000		19	23	06/79	20	0	20	X
	Event 3000	8080-A		22	22	12/79	11	0	11	X
	League Master	8080-A		23	23	--/80	2	0	2	X
						TOTAL	189	12	201	
Applied Data Processing, Inc.*	Resource 50	Nova 3/4		31	52	09/79	1	0	1	X
	Resource 100	Nova 3/12		41	72	06/79	16	0	16	X
						TOTAL	17	0	17	
Applied Digital Data Systems, Inc.*	Adds/Vantage	8080		11	14	07/76	550	400	950	X
Astrocom	Series 760	Z80		16	20	06/79	30	0	30	NA
Automated Business Concepts	Mesa Two	Nova 4	b	50	73	04/78	70	0	70	4
	Maps	Digidyne		40	50	02/82	0	0	0	30
						TOTAL	70	0	70	34
Ball Computer Products*	DASL	Nova 2/10		38	40	06/75	3	0	3	X
Basic Four Corporation	200	BFC 1340		25	29	02/78	600	800	1,400	X
	350	BFC 1300, Microdata	c	34	34	09/71	500	576	1,076	X
	400	BFC 1300, Microdata	c	37	45	09/71	1,712	1,739	3,451	X
	410	BFC 1300		33	41	10/78	1,500	1,850	3,350	X
	500	BFC 1300, Microdata	c	39	50	07/72	100	82	182	X
	600	BFC 1300, Microdata	c	51	65	03/75	300	308	608	X
	610	BFC 1310		51	66	01/78	1,450	1,250	2,700	X
	700	BFC 1320		115	130	--/77	109	99	208	X
	730	BFC 1350		95	124	06/78	530	600	1,130	X
	210	BFC 1345		25	29	07/81	50	30	80	X
	310	BFC 1350		55	60	01/82	0	0	0	NA
	510	BFC 1345		44	61	--/80	330	270	600	NA
	710	BFC 1350		69	72	01/82	0	0	0	NA
	810	BFC Basic 4		117	150	4Q/82	0	0	0	NA
	Newport	Basic 4		150	230	4Q/82	0	0	0	NA
						TOTAL	7,181	7,604	14,785	
Basic Time	B-100	Digidyne		16	16	07/79	130	10	140	X
	B-200	Digidyne		20	20	11/79	35	5	40	X
						TOTAL	165	15	180	
Billings Computer Co.*	BC-104	8080-A		12	22	--/77	400	0	400	X
BRD, Inc.*	Dolphin	6800		18	20	06/77	400	30	430	X
	Purpose	6800		10	13	01/78	160	5	165	X
						TOTAL	560	35	595	
Briareus	Briareus	EDS Point 4		20	40	01/76	140	0	140	35
Burroughs	B20	B20	d	8	20	07/82	0	0	0	NA
	B80	B80		17	29	11/76	7,200	11,700	18,900	NA
	B90	B90		18	33	12/79				NA
	B700	B700		26	68	03/73	2,000	1,600	3,600	X
	B800	B800		35	51	05/77	5,700	3,200	8,900	NA
	B900	B900		61	76	08/80	400	150	550	NA
						TOTAL	15,300	16,650	31,950	
Business Systems Products*	Adviser	C.A. Syfa		42	50	07/76	111	0	111	X
Cado	Cado Sys. 20	8080		12	16	04/76	430	202	632	X
	Cado Sys. 40, 1000	8080		18	20	03/77	568	114	682	X
	Cado Sys. 20/4 20/24	8085		16	27	04/78	2,755	1,251	4,006	NA
	Cado Sys. 40/4, 40/44	8085		20	37	05/78	431	21	452	NA
	Cado Sys. 20/2, 20/22	8085		15	16	06/79	437	228	665	NA
	Cado Sys. 20/28	Dual 8085		23	30	05/80	350	157	507	NA
	CAT I	8085		10	12	05/80	686	432	1,118	NA
	CAT II	8085		15	17	08/80	272	78	350	NA
	CAT III	8085		9	13	06/82	0	0	0	NA
						TOTAL	5,929	2,483	8,412	
Cascade Data, Inc.	80/20, 30, 40	Concept		28	42	01/70	50	0	50	X
	Concept II	Concept		27	35	06/75				X
	Concept III	Concept		32	39	01/78	334	15	349	X
	Concept IV	Concept		17	19	04/78				X
						TOTAL	384	15	399	

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Centurion Computer Corporation	Centurion IA	CC-205	e	18	19	--/77	60	0	60	X
	Centurion IIA	CC-205		27	30	--/75	95	0	95	X
	Centurion Ser. 100	CC-205		15	15	--/79	124	20	144	X
	Centurion III	CPU 5		30	36	--/74	604	46	650	NA
	Centurion Ser. 200	CPU 5		27	27	--/79	130	34	164	NA
	Centurion Ser. 6000	CPU 6		24	30	01/80	130	30	160	NA
	Centurion Ser. 5200	CPU 6		21	NA	05/82	0	0	0	NA
	Centurion Ser. 5300	CPU 6		23	NA	05/82	0	0	0	NA
	Micro Plus Series	CPU 5		10	NA	01/82	0	0	0	NA
						TOTAL	1,143	130	1,273	
Century Computer Corporation	CC200	C-200		27	49	03/75	661	272	933	350
	Opus III	C-200		15	22	02/71	560	110	670	X
	BPM	C-200		19	50	12/80	131	0	131	NA
						TOTAL	1,352	382	1,734	
CIE Systems	680/20	68000		9	14	07/82	0	0	0	NA
	680/40	68000		19	24	06/82	0	0	0	NA
Cincinnati Milacron*	George 40	CIP/2200B		16	20	02/77				X
	George 60	CIP/2200B		26	34	--/76				X
	George 70	CIP/2200B		26	35	--/76	670	150	820	X
	George 80	CIP/4400		43	60	12/76				X
	Other	CIP/2200B		23	34	--/74				X
Clary Data Systems*	404	Clary		6	30	01/70	100	32	132	X
Complete Computer Corporation	10, 11, 12	Nova 3/12, 4X		34	44	03/74	36	0	36	15
	14, 16, 18	Nova 3/12, 4X		45	58	10/76	29	0	29	X
	20, 22, 24	Nova 3/12, 4X		58	74	09/77	8	0	8	X
	40, 44	Nova 4/X		48	65	01/80	24	0	24	7
						TOTAL	97	0	97	22
Compucorp*	402	Compucorp 3000		13	15	01/76	15	455	470	X
	450	Compucorp 3000		20	22	04/76	40	115	155	X
						TOTAL	55	570	625	
Computer Hardware, Inc.	2120	CHI		15	50	05/75	10	0	10	X
	2130C	CHIC		32	75	07/74	350	4	354	X
	2130D	CHID		44	120	01/78	10	1	11	X
	3230	CHI		15	50	06/76	100	0	100	X
	4210	CHI		13	13	09/77	4	0	4	X
	4250	CHI		37	45	06/78	7	0	7	X
						TOTAL	481	5	486	
Computer Interactions, Inc.	Compo II-8	PDP-8/e,f,m		31	50	11/72	600	0	600	NA
	Compo II-11	PDP-11		37	53	06/75	440	0	440	NA
	Word Pro II	PDP-80, Nova, HP		13	17	02/77	820	0	820	NA
						TOTAL	1,860	0	1,860	
Data General	CS/5	Micro Nova		6	11	3Q/82	0	0	0	NA
	CS/10	Micro Nova		11	13	11/80	720	480	1,200	NA
	CS/20	Micro Nova		11	20	07/78	180	120	300	NA
	CS/30	Micro Nova		21	25	08/79	780	220	1,000	NA
	CS/40	Nova 3/12		33	40	10/77	600	400	1,000	NA
	CS/50, CB50	Micro Nova 45, 4X		32	65	--/80	675	225	900	NA
	CS/60	Eclipse		40	75	07/78	300	100	400	NA
	CS/70	Eclipse		36	43	11/80	120	80	200	NA
	CS/100	Eclipse		18	27	3Q/82	0	0	0	NA
	CS/200	Eclipse		25	30	3Q/82	0	0	0	NA
	Design Data EC300	Eclipse C/300	f	60	150	03/76	50	10	60	X
	Design Data N312	Nova 3/12	f	31	75	08/75	90	10	100	X
	Synergist 1500	Micro Nova	g	8	24	--/76	15	5	20	NA
	Synergist 1550	Micro Nova	g	14	21	07/78	35	5	40	NA
	Synergist 2500	Nova 3/12	g	27	40	--/76	150	10	160	NA
	Synergist 3700	Nova 3/D	g	40	60	--/76	15	5	20	NA
						TOTAL	3,730	1,670	5,400	
Datamedia Corporation	932	68000		15	20	3Q/82	0	0	0	NA
Decision Data Computer Corporation*	System/4	System/4		23	37	08/76	15	0	15	X
Diablo Systems, Inc.	3200	8080	h	19	23	01/77	2,100	2,600	4,700	NA
D.H. Minicom, Inc.	32/64	Point 4		16	20	05/81	135	0	135	NA
Digital Equipment Corporation	Datasystem 300	PDP-8, PDP-11		14	30	--/72	8,900	5,700	14,600	NA
	Datasystem 500	PDP-11		58	115	--/72	1,900	1,850	3,750	NA
	DEC Station 78	PDP-8		8	11	09/78	1,650	1,100	2,750	NA
	DEC Station 88	PDP-8A		12	15	03/78				NA
	Datasystem 700	VAX 11/750		NA	138	--/81	95	0	95	NA
	Datasystem 700	VAX 11/780		NA	300	--/81	45	0	45	NA
						TOTAL	12,590	8,650	21,240	
Digital Systems Corporation	Galaxy/5	Galaxy/5		90	120	01/76	35	0	35	20
	Galaxy/3	Galaxy/3		50	65	01/80	6	0	6	
						TOTAL	41	0	41	20
Dimis, Inc.	Total 100	Modcomp II, Classic	i	110	155	06/74	52	0	52	NA

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Display Data Corporation	Insight	Microdata 1600/30		38	59	01/74	1,500	12	1,512	400
	ELS System	Microdata 1600/30		27	33		25	0	25	X
						TOTAL	1,525	12	1,537	
DTC	Task Master	8080		17	19	09/78	25	90	115	X
Evolution Computer Systems Corporation	Series I	Multi 6	j	65	77	11/73	206	28	234	X
	Series II	Multi 6		88	97	10/77	180	10	190	X
	240	Multi 6		37	42	02/81				
	260	Multi 6		55	63	02/81	165	22	187	200
	280	Multi 6		94	105	02/81				
						TOTAL	551	60	611	200
Financial Computer Corporation*	System 111/6	System 111		19	25	09/77	28	0	28	X
	System 111/8	System 111		23	32	09/77	22	0	22	X
	System 111/10	System 111		30	45	01/75	440	55	495	X
						TOTAL	490	55	545	
General Automation	OM-130/2	SPC-16/45		28	28	12/74	150	350	500	X
	OM-130	SPC-16/45		30	38	12/74	80	180	260	X
	OM-140	SPC-16/65		48	80	01/75	7	18	25	X
	440-DS	GA 16/440		38	70	01/76	35	65	100	X
	460-DS	GA 16/460		35	80	11/78	10	30	40	X
	Instacode	GA 16/230		34	34	06/80	8	6	14	15
						TOTAL	290	649	939	15
General Information Systems	GIS-350 ABLE	PDP-11/34		36	40	01/76	20	0	20	X
General Robotics Corporation	Gemini Series	LSI-11		10	21	07/76	251	250	501	100
	Tristar Series	LSI-11		11	22	07/76	111	110	221	20
	Pegasus Series	LSI-11		18	39	09/77	157	157	314	X
	Scorpio	LSI-11		7	10	07/81	19	19	38	250
						TOTAL	538	536	1,074	370
GRI Computer Corporation	System 99	GRI 99/50		30	35	11/74	196	88	284	X
	System 99/E	GRI 99/52		43	50	11/77	35	15	50	X
	GRIP	GRI		30	30	11/78	25	0	25	X
						TOTAL	256	103	359	
Hewlett-Packard	HP 250	HP 250		19	34	09/78	1,400	1,900	3,300	1,500
	HP 300	HP 300		30	58	09/78	210	300	510	20
						TOTAL	1,610	2,200	3,810	1,520
ICL, Inc. (U.S. Only)	System 25	ICL		35	80	01/82	0	-	0	NA
	DBS 20	ICL		9	25	03/82	0	-	0	NA
Infotecs	IMP	IM 6100		10	15	09/77	848	128	976	800
	CC2	IM 6100		16	22	01/80	999	93	1,092	
						TOTAL	1,847	221	2048	800
IBM	System/32	IBM S/32	k	27	42	03/75	5,600	4,600	10,200	X
	System/34	IBM S/34		35	66	12/77	42,500	24,000	66,500	20,000
						TOTAL	48,100	28,600	76,700	20,000
International Computing Corporation*	System 95/99	Nova 2/10		24	35	10/72	9	0	9	X
Kalbro Computer Services	BDS 500	Microdata 1600	l	30	48	03/77	41	0	41	
	BDS 1000	Microdata 1600		35	55	06/72	82	0	82	10
	BDS 2000	Microdata 1600		43	73	10/73	94	0	94	
	BDS 4000	Microdata 1600		51	85	10/79	8	0	8	X
						TOTAL	225	0	225	10
Keydata	Unity Series	Nova 3/4, 3/12, 30		48	80	04/79	35	1	36	X
Lockheed Electronics Company, Inc.	System III	Lockheed Sue		30	50	01/73	465	130	595	X
Logical Machine Corporation	ADAM I	ADAM		30	35	04/75	479	547	1,026	X
	TINA	TINA		18	20	12/78	400	1,100	1,500	NA
	ADAM II	ADAM		25	30	10/79	38	220	258	X
	GOLIATH	GOLIATH		28	45	11/80	40	100	140	NA
						TOTAL	957	1,967	2,924	
Martin Wolfe, Inc.*	Mesa Two 7000	DCC-116		54	81	12/71	140	0	140	X
	Mesa Two 4000	DCC-116		62	93	02/76	3	0	3	X
						TOTAL	143	0	143	
Merrator Business Systems	4000	8086		22	23	10/80	84	156	240	300
	3000	8088		15	16	05/81	196	364	560	100
	5000	8086, 8087		33	NA	05/82	0	0	0	100
						TOTAL	280	520	800	500
Micro Business Applications	Micron 400	Z80, 8085		15	19	12/81	2	0	2	NA
	Micron 700	Z80, 8085		25	30	03/80	29	0	29	X
	Micron 800	8085		25	33	05/81	6	0	6	NA
						TOTAL	37	0	37	
Microdata	Reality	Microdata 1600		32	60	12/73	2,780	516	3,296	NA
	Reality 2000	Microdata 1600		32	37	06/79	109	11	120	NA
	Reality 4000	Microdata 1600		38	49	06/79	566	64	630	NA
	Reality 6000	Microdata 1600		51	66	06/79	1,106	117	1,223	NA
	Reality 8000	Microdata 1600		89	109	02/80	351	46	397	NA
	Sequel	Microdata		153	163	12/81	4	0	4	NA
						TOTAL	4,915	754	5,670	

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Name of Manufacturer	Computer Model	Processor Model	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Micromation	Marmer	Z80-A		13	18	01/80	150	200	350	NA
Microstar, Inc.*	Microstar I	Z80		13	17	12/78	5	0	5	X
	Microstar II	Z80		14	19	12/78				X
Microtech Business Systems, Inc.	System 50	Point 4		19	23	--/80				
	System 100	Point 4		20	29	--/80				
	System 200	Point 4		23	31	--/71	355	1	356	200
	System 300	Point 4		27	39	--/79				
	System 400	Point 4		46	60	--/78				
Midwest Scientific	MSI-6800AW	6800	m	8	11	05/79	700	850	1,550	200
Mini-Computer Systems, Inc.	Micos 100	Nova 3/4		26	40	08/77	170	190	360	NA
	Micos 200	Nova 3/12		40	60	--/73	1,035	465	1,500	NA
	Micos 300	Dual Nova 3/12		100	140	01/79	16	4	20	NA
	Micos 75	Nova 3/4		26	26	09/79	18	16	34	X
	Micos 85	Nova 3/4		36	41	--/80	22	28	50	X
						TOTAL	1,261	703	1,964	
Minutemen Computer Corporation	1774	Nova 3/4, 4/5		30	40	11/71	80	0	80	
	1775	Nova 3/12, 4/16		32	44	03/72	50	0	50	70
	1776	Nova 3/12, 4/16		35	59	03/72	60	0	60	
	1776/A	Nova 3/12, 4/16		35	65	05/77	55	0	55	
						TOTAL	245	0	245	
Mylee Digital Sciences, Inc.	3000 Series	Mylee 3G		33	56	05/76	230	0	230	70
NCR Corporation	8130	NCR		19	23	03/78				NA
	8140	NCR		15	16	05/80	933	3,550	4,483	NA
	8150	NCR		27	34	02/77				NA
	9010	NCR		14	18	04/81	130	150	280	NA
	9020	NCR		25	28	03/81	150	300	450	NA
	9040	NCR		107	120	05/81	215	700	915	NA
	9050	NCR		135	150	05/81	21	25	46	NA
	8200	NCR		33	63	09/74				NA
	8230/31	NCR		27	42	06/77	5,850	6,800	12,650	NA
	8250/51	NCR		29	60	12/76				NA
						TOTAL	7,299	11,525	18,824	
NEC (U.S. Only)	210	NEC		16	17	06/79	70	-	70	NA
	230	NEC		20	29	06/79	500	-	500	NA
	250	NEC		30	55	06/79	200	-	200	NA
	270	NEC		27	73	11/81	10	-	10	NA
						TOTAL	780	-	780	
Nixdorf Computer (U.S. Only)	8870/1	8013, 8015		29	45	--/78	750	-	750	NA
	8870/3	8033, 8035		38	60	01/81		-		NA
Olivetti (U.S. Only)	S-6000	Olivetti		19	35	01/82	0	0	0	NA
Norfield Datasystems, Inc.*	Nova System	Nova		35	50	06/73	20	0	20	X
Novell Data Systems, Inc.	Nexus I	Nexus		12	12	04/81	150	25	175	NA
OSM Computer Corporation	Zeus II	Z80		6	23	03/82	0	0	0	NA
Plessy Peripheral Systems	SBC 200 Series	LSI 11/23		26	34	11/81	0	40	40	540
Prodigy Systems, Inc.	Prodigy 1	Z80-A		10	15	05/79	265	35	300	NA
	Prodigy 2	Z80-A		13	18	06/80				NA
Programmed Control Corporation	Prophet 21/1	TI 960-B		42	75	--/72	40	0	40	1
	Prophet 21/2	TI 990/10		57	100	01/78	73	2	75	22
						TOTAL	113	2	115	23
Q1 Corporation	Q1/LMC	Z80, 8080		10	21	02/74	580	75	655	NA
	Q1/Lite	Z80		6	24	02/77	610	425	1,035	NA
	Q1 Microlite	Z80		10	13	01/79	222	323	545	NA
	Q1 68000	68000		NA	NA	05/82	0	0	0	NA
						TOTAL	1,412	823	2,235	
Qantel	210, 110	Q29		12	17	11/77	215	690	905	10
	800, 900	Q7		28	29	05/75	85	62	147	X
	950	Q7		28	33	11/75	600	240	840	X
	960	Q7.5		30	35	11/76	300	100	400	X
	970	Q29B		36	40	01/79	250	150	400	X
	1200	Q7		42	59	11/75	200	20	220	X
	1300	Q7.5		42	59	11/75	40	15	55	X
	1400-2	Q7.5		44	70	05/77	360	170	530	X
	1450-2	Q29B		45	80	01/79	200	50	250	X
	200 Series	Q29B		30	57	03/80	1,089	654	1,743	1,300
	300 Series	Q29B		50	80	03/80	291	57	348	250
	20 Series	Q29B		23	30	11/81	45	30	75	600
						TOTAL	3,675	2,238	5,913	2,150
Quodata Corporation	F-250, 500	PDP-8		15	30	--/72				X
	F-661, 760 820, 960	PDP-11		44	100	--/75				X
	Q-620, 650	PDP-11, 34, 44		40	120	--/80	296	60	356	50
	720, 750 820, 850, 880 950, 980	VAX								
	QDP/78	PDP-8		13	13	--/77				X
	ECS/7800	PDP-8		10	11	--/77				X
Quota	900 Series	8085, 8086, 8088		15	18	01/82	0	0	0	150

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Name of Manufacturer	Computer Model	Processor Model	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Randal Data Systems*	R-100 Series	Randal		14	17	10/75	257	13	270	X
	R-200 Series	Randal		24	30	10/76	382	0	382	X
	R-300 Series	Nova 2/10		34	45	06/74				X
	R-400 Series	Nova 2/10		36	45	06/74	27	0	27	X
	R-500 Series	Randal		42	47	10/77	45	0	45	X
						TOTAL	711	13	724	
Retail Sciences, Inc.	Clerk 700	PE 5/16		19	19	10/78	18	5	23	X
	Clerk 800	PE 5/16		25	25	04/79	25	15	40	X
						TOTAL	43	20	63	
Rexon Business Machines	RX15	8086		20	22	02/81	131	183	314	500
	RX20	8086		23	28	04/80	143	37	180	100
	RX30	8086		27	43	07/79	244	189	433	300
						TOTAL	518	409	927	900
Reynolds & Reynolds	VIM III	BTI 500		30	45	--/78	2,100	400	2,500	NA
	Expansion 6000	Z80		36	42	05/81	10	1	11	NA
						TOTAL	2,110	401	2,511	
R2E of America (U.S. Only)	XM	Z80		NA	20	03/82	0	-	0	NA
Sentinel Computer Corporation	Sentinel Ser.	8086		21	39	07/79	100	50	150	NA
A.O. Smith*	Mesa Two	Nova 3		58	58	05/77	10	0	10	X
Space Byte Computer*	DBM/1	8085		6	13	07/78	55	10	65	X
	DBM/2	Z80		13	15	06/79	10	0	10	X
						TOTAL	65	10	75	
Span Mangement Systems*	TSS2	IBM Series/1		31	31	--/77	10	3	13	X
Sperry Univac	BC-7	Univac		26	46	04/77	1,754	831	2,585	183
STC Systems, Inc.	2000	Nova 3/12		34	80	09/72	108	2	110	X
	3000	Nova 3D		55	90	11/75	72	2	74	X
	4000	Nova 4		45	65	11/77	60	0	60	5
	5000	Nova 4X		54	125	11/77	65	0	65	20
	6000	Nova 4X		108	225	10/82	0	0	0	2
						TOTAL	305	4	309	
Symcro Systems, Inc.	SB 700	Z80		19	30	04/81	3	0	3	30
Technico	TI32	TI9900		15	20	09/80	50	0	50	150
Tri-Star, Inc.*	TTK-10	Nova 3/12		45	55	02/76	12	0	12	X
	TEK-80	Nova		52	67	04/76	4	0	4	X
						TOTAL	16	0	16	
Ultimate Corporation	1000	LSI		29	35	--/82	0	0	0	NA
	2000	LSI		34	40	11/81	5	3	8	40
						TOTAL	5	3	8	40
Vanguard Computer Systems, Inc.	V400	Raytheon RDS 500		45	52	06/77	2	0	2	X
	V500	Raytheon RDS 500		65	85	03/76	6	3	9	NA
						TOTAL	8	3	11	
Wang	2200	2200		10	19	04/73	12,960	8,540	21,500	NA
	2200VP	2200VP		11	26	09/76	8,400	5,600	14,000	NA
	2200MVP	2200MVP		18	36	01/78				NA
	VS	2200VS		33	114	10/77	2,400	1,600	4,000	NA
	2200LVP	2200LVP		33	25	09/80				NA
	2200SVP	2200SVP		10	14	09/80	2,500	1,700	4,200	NA
						TOTAL	26,260	17,440	43,700	
Wintex Computer Corporation	200NS	Wintex		12	18	01/75	95	1	96	X
	MT 200	Wintex		10	20	10/79	160	0	160	100
	MT 86	Wintex		10	15	--/82	0	0	0	50
						TOTAL	255	1	256	150
Zilog	8000	Z8000		30	30	07/81	80	20	100	1,000
	MCZ 1/70	Z80		18	18	01/80	100	70	170	X
						TOTAL	180	90	270	1,000

	U.S.	International	World
TOTAL OF ABOVE	170,106	114,341	284,447
TOTAL OTHER VENDORS	2,500	600	3,100
TOTAL	172,606	114,911	287,547

Notes:

(a) Includes installations of Eldorado 140.
(b) Corporate name changed from Broadcast Management Concept, March 1, 1980.
(c) Used Microdata processors until 11/76.
(d) Includes retirements of Model B700.
(e) Corporate name changed from Warrex Computer Corporation when it was purchased by Electric Data Systems, January 29, 1981.
(f) Design Data was acquired by Data General in February 1977.
(g) Digital Computer Controls was acquired by Data General in early 1977.
(h) Marketed in the U.S. by Shasta General Systems.
(i) Rental price $3,000/month.
(j) Computer hardware division purchased from Pick and Associates during 1980.
(k) U.S. installation figures account for retirements.
(l) Northrop Data Systems was acquired by Kalbro Corporation in 1981.
(m) The average price during 1981 was $25K, but because of the weighted average, it appears lower.
(*) Not currently active in manufacturing or marketing small business computers.
(NA) Data is not available.
(X) Model not in new production.

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DESKTOP COMPUTER CENSUS

The Desktop Computer Census counts those computers which typically are small enough to be used on a desktop, and are found in a variety of end-user environments including business, home, hobby, personal, educational, and scientific. By IDC definition the Desktop Computer is microprocessor-based, includes its own power supply and enclosure, has the capability for attaching output peripherals -- video screen and/or printer -- and can also attach storage devices such as floppy diskettes, tape cassettes, or in some cases fixed disks. The computer is programmable in BASIC or equivalent level language, has a minimum of 4K RAM and costs from less than $1,000 up to $15,000 in a basic configuration. Microcomputer Boards and kits are not counted here.

DESKTOP CENSUS AS OF JANUARY 1, 1982

Name of Manufacturer	Computer Model	Processor Model	Notes	Purchase Price in Dollars Basic	Purchase Price in Dollars Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Advanced Micro Digital Corporation	Super/Net	Z80		875	875	01/82	0	0	0	5,000
Algorithmics, Inc.	Alga 2100	Z80		9,900	14,000	01/78	89	1	90	NA
Altos Computer Systems	ACS 8000-2	Z80		4,500	5,000	06/77				NA
	ACS 8000-5	Z80		5,990	7,000	10/79				NA
	ACS 8000-6	Z80		9,500	10,450	11/79	10,800	7,200	18,000	NA
	ACS 8000-10	Z80		8,500	8,500	05/81				NA
	ACS 8000-12	Z80		9,990	9,990	09/81				NA
	ACS 8000-14	Z80		11,990	11,990	09/81				NA
	ACS 8600-10	8086		10,500	10,500	05/82	0	0	0	NA
	ACS 8600-12	8086		12,500	12,500	02/82	0	0	0	NA
	ACS 8600-14	8086		14,500	14,500	05/82	0	0	0	NA
						TOTAL	10,800	7,200	18,000	
A.M. Jacquard	J500	A.M. Jacquard		12,000	16,000	12/78	970	1,020	1,990	100
APF Electronics	IM1	6800		400	1,115	11/79	14,000	0	14,000	NA
Apple	Apple II	6502		1,330	2,500	05/77	240,000	60,000	300,000	NA
	Apple III	6502		4,240	6,000	11/80	8,000	2,000	10,000	NA
						TOTAL	248,000	62,000	310,000	
Archives, Inc.	Archives Business Sys.	Z80		5,500	6,500	01/80	1,000	200	1,200	NA
Artec Electronics, Inc.	Artec Systems	8085 A-2		6,300	7,300	11/80	79	3	82	NA
Atari	400	6502		399	600	09/79	65,000	15,000	80,000	NA
	800	6502		899	1,100	09/79	30,000	6,000	36,000	NA
						TOTAL	95,000	21,000	116,000	
Basic Four	S10	Z80		5,995	5,995	3Q/82	0	0	0	NA
Billings Computer Co.	BC12FD	Z80		6,600	9,500	03/79	810	1,190	2,000	NA
	BC12DF2M	Z80		9,900	12,900	03/79				
BRD, Inc.*	Small Fry	6800		7,000	10,000	04/79	50	0	50	X
Canon (U.S. Only)	BX-3	6809		5,600	5,600	05/81	100	-	100	NA
	CX-1	6809		4,995	7,000	05/81	500	-	500	NA
						TOTAL	600	-	600	
Century Computer Corp.	Vanguard 800	8086		10,000	12,000	06/82	0	0	0	500
CIE Systems	680/10	68000		15,000	15,000	04/82	0	0	0	NA
Codata Systems Corp.	CTS-100	Z80A		7,392	9,937	06/80	300	0	300	700
	CTS-300	68000		11,405	13,950	06/81	1,000	0	1,000	1,000
						TOTAL	1,300	0	1,300	1,700
Columbia Data Products, Inc.	500	Dual Z80-A		3,000	3,995	09/79	500	52	552	700
	964	Dual Z80-A		3,197	4,995	09/79	256	78	334	700
	M64	Z80-A		1,405	2,249	12/79	258	44	302	500
	F64	Z80-A		2,877	4,495	02/80	35	21	56	150
						TOTAL	1,049	195	1,244	2,050
Commodore	PET/CBM	6502		995	1,295	10/77	100,000	145,000	245,000	NA
	VIC 20	6502A		299	400	06/81	20,000	30,000	50,000	NA
	Super Pet	6502B		1,995	1,995	07/81	9,000	11,000	20,000	NA
						TOTAL	129,000	186,000	315,000	
Compal	8100	8080		12,000	12,000	12/76	400	10	410	X
	8200	Z80		12,500	14,000	01/80	800	25	825	800
	EZ Type	Z80		8,995	9,995	03/81	50	0	50	100
						TOTAL	1,250	35	1,285	900
Compucorp	625	Z80		5,000	8,500	06/77	200	500	700	X
	655	Z80		4,000	6,500	04/79	2,000	4,000	6,000	NA
	665	Z80		5,000	7,000	04/79	1,000	2,000	3,000	NA
	675	Z80		7,000	9,078	06/79	3,000	6,000	9,000	NA
	685	Z80		12,000	14,000	05/81	300	600	900	NA
						TOTAL	6,500	13,100	19,600	
Computer Data Systems*	Versatile 4	8085		3,800	4,500	11/77	700	150	850	X
	Versatile 3B	8085		4,900	5,500	11/77	250	50	300	X
						TOTAL	950	200	1,150	

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Computer Hardware, Inc.	4800	CHI	a	8,850	10,500	04/81	5	0	5	NA
Computer Interface Tech.	Pense System	Micro-engine		5,295	8,000	11/79	400	355	755	NA
Computhink, Inc.	Minimax	6502		6,950	6,950	01/80	250	650	900	NA
	Eagle 32	68000		7,950	9,000	02/82	0	0	0	NA
						TOTAL	250	650	900	
Convergent Technologies	AWS	8088		5,795	6,795	11/81	400	100	500	NA
	IWS	8086		8,400	16,000	10/80	1,600	400	2,000	NA
						TOTAL	2,000	500	2,500	
Cromemco	System Zero/D	Z80-A		2,995	4,990	12/80	3,000	1,500	4,500	NA
	System Zero	Z80-A		995	2,990	12/80	1,000	400	1,400	NA
	System One	Z80-A		3,995	7,585	12/81	500	200	700	NA
	System Three	Z80-A		5,995	10,943	08/77	8,000	4,000	12,000	NA
						TOTAL	12,500	6,100	18,600	
Cyber Systems, Inc.	CYKEY 9910	Z80		7,000	9,000	06/81	15	0	15	450
Datamac Computer Sys.	1200 Series	Z80		2,295	4,195	07/81	100	0	100	1,000
Data Technology Ind.	System 10	Z80		3,950	3,950	01/80	400	850	1,250	4,500
Digilog Business Sys.	1000	Z80-A		3,995	6,495	11/80	950	50	1,000	NA
	1500	Z80-A		8,795	8,795	07/81	110	15	125	NA
	1800	Z80-A		9,795	9,795	03/82	0	0	0	400
	2000	Dual Z80-A		8,400	8,400	09/80	200	0	200	X
						TOTAL	1,260	65	1,325	
Digilog, Inc.	7120	Dual Z80-A		8,400	8,400	03/79	0	1,500	1,500	X
	7130	Dual Z80-A		10,500	10,500	07/81	0	200	200	2,000
						TOTAL	0	1,700	1,700	2,000
Digital Equipment Corporation	Mini MINC	LSI-11		9,900	11,000	10/79	4,500	600	5,100	3,000
	Data Sys. 150	LSI-11		10,900	15,000	03/79	1,200	900	2,100	X
	VT100	Z80(18XKit)		5,000	5,000	01/82	0	0	0	NA
						TOTAL	5,700	1,500	7,200	3,000
Digital Microsystems	DSC-2	Z80-A		4,995	5,895	11/77	5,140	2,210	7,350	80
	DSC-2585	Z80-A		9,950	9,950	06/78	300	0	300	X
	DSC-3	Z80-A		5,495	15,000	11/80	515	735	1,250	3,000
	DSC-4	Z80-A		6,950	10,000	10/80	110	135	245	500
	DSC-3F	Z80-A		3,995	3,995	04/82	0	0	0	1,500
						TOTAL	6,065	3,080	9,145	5,080
Durango Systems	F85	8085		9,950	12,536	10/78	1,875	1,875	3,750	1,600
	800 Series	8085		8,450	9,950	03/82	0	0	0	NA
	900 Series	8085		9,950	12,950	03/82	0	0	0	NA
						TOTAL	1,875	1,875	3,750	
Dynabyte	5200	Z80		4,495	5,000	--/78	1,500	700	2,200	100
	5300, 5305	Z80		4,995	7,000	--/79	900	600	1,500	500
	5400	Z80		6,995	8,500	--/79	450	250	700	X
	5800	Z80		17,995	23,000	--/80	125	75	200	X
	5900	Z80		18,995	25,000	--/80	175	100	275	X
	5505	Z80		6,995	10,000	--/81	600	500	1,100	1,700
	5605	Z80		7,295	11,000	--/81	600	400	1,000	2,500
	5710	Z80		8,995	13,000	--/81	500	300	800	2,000
						TOTAL	4,850	2,925	7,775	6,800
Exidy Systems, Inc.	Sorcerer	Z80		1,495	2,890	08/78	10,000	10,000	20,000	10,000
	80/1	Z80		1,495	5,500	03/80				
	80/2	Z80		1,495	7,295	03/80				
Findex, Inc.	100	Z80		4,500	5,980	07/79	24	6	30	X
	128	Z80		8,230	8,980	--/80	0	1	1	0
	234	Z80		6,980	8,500	01/81	195	625	820	NA
						TOTAL	219	632	851	
Fortune Systems Corp.	32:16	68000		4,995	7,000	04/82	0	0	0	16,000
Franklin Computer	ACE 100	6502		1,595	2,400	03/82	0	0	0	15,000
General Robotics*	Polaris	LSI-11		13,000	13,000	04/78	0	100	100	X
Gnat Computers, Inc.	System 10	Z80-A, 8085		4,650	6,100	12/79	150	50	200	2,000
	System 10M	Z80-A, 8085		5,450	7,000	10/80	80	20	100	
	System 10H	Z80-A, 8085		8,350	8,350	07/81	5	0	5	
						TOTAL	235	70	305	
Grid Systems	Compass Computer	8086		8,100	8,100	09/82	0	0	0	NA
Hardy Computer Corp.	8001	8086		6,900	10,000	07/81	43	7	50	NA
	801	Z80-A		1,350	3,000	06/80	350	150	500	NA
						TOTAL	393	157	550	

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Name of Manufacturer	Computer Model	Processor Model	Notes	Purchase Price in Dollars Basic	Purchase Price in Dollars Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Hewlett-Packard	9825	HP		5,900	10,900	01/76	11,170	19,130	30,300	400
	9826A	68000		8,950	12,700	06/81	1,171	1,529	2,700	3,550
	9830	HP		4,900	16,500	11/72	5,000	5,000	10,000	X
	9835	HP		9,000	13,200	12/78	3,250	4,100	7,350	NA
	9836	68000		11,950	15,750	01/82	0	0	0	3,800
	9845	HP		12,000	28,800	11/77	5,700	8,300	14,000	NA
	83	HP		2,250	2,550	01/81	2,000	2,000	4,000	NA
	85	HP		2,750	3,550	01/80	19,000	20,000	39,000	NA
	87	HP		2,495	4,790	03/82	0	0	0	NA
	125	HP		4,950	6,200	09/81	1,155	495	1,650	NA
						TOTAL	48,446	60,554	109,000	
IMSAI*	VDP-40	8085		5,300	5,300	--/78	380	20	400	X
	VDP-80	8085		7,800	7,800	--/77	670	130	800	X
						TOTAL	1,050	150	1,200	
Industrial Microsystems	5000	8080, Z80		3,495	5,300	06/79	2,000	1,000	3,000	5,800
	8000	8080, Z80		4,495	7,500	06/79	3,500	3,300	6,800	10,000
						TOTAL	5,500	4,300	9,800	15,800
Information Support Systems, Inc.	Voyager I	8085		4,995	4,995	04/81	48	0	48	X
	Voyager II	8085		9,995	9,995	04/81	48	0	48	NA
	Voyager III	8085		9,990	9,990	2Q/82	0	0	0	NA
						TOTAL	96	0	96	
Integrated Business Computers	IBC	Z80-A		9,000	13,000	--/80	200	300	500	X
	Cadet	Z80-B		10,000	15,000	07/81	200	300	500	500
	Ensign	68000		10,000	15,000	3Q/82	0	0	0	100
						TOTAL	400	600	1,000	600
IBM	5100	IBM		6,300	13,000	11/75	4,300	1,000	5,300	X
	5110	IBM		9,900	17,000	02/78	13,500	2,600	16,100	X
	5120	IBM		9,340	15,000	02/80	6,500	1,600	8,100	X
	5150 (Personal Computer)	8088		1,565	5,055	10/81	34,900	100	35,000	NA
	Sys/23 Datamaster	8085		9,830	12,530	07/81	3,700	1,300	5,000	NA
						TOTAL	62,900	6,600	69,500	
Intertec Data Systems	Super Brain	Z80-A		2,995	2,995	10/79	13,650	8,050	21,700	NA
	Super Brain QD	Z80-A		3,995	3,995	04/80				NA
	Compustar	Z80-A		2,500	3,500	01/81	2,600	1,800	4,400	NA
						TOTAL	16,250	9,850	26,100	
Konix International Corporation	System 80	Z80		3,700	4,000	06/78	53	14	67	X
	System 81	Z80		3,700	4,100	01/80	18	1	19	X
						TOTAL	71	15	86	
Lanier	Computer EZE	Z80		7,495	9,200	07/81	450	0	450	NA
M/A-Com Office Sys.	Challenger	6502/6800	b	1,260	4,500	--/78	6,450	650	7,100	NA
Micro Expander	Expander	Z80		2,200	4,250	11/81	60	40	100	7,500
Micro V Corp.	Microstar I	8085A		7,500	15,000	08/78	1,750	1,750	3,500	NA
	Microstar II	8086		12,000	25,000	09/80				NA
	Series 3000	8086		15,500	24,000	05/81				NA
Micromation	M/SYSTEM	Z80-A		3,500	8,300	01/80	2,000	3,000	5,000	NA
Monroe Systems for Business	OC8820	Z80-A		4,385	4,385	12/81	300	100	400	NA
	EC8800	Z80		3,295	3,295	12/81	300	100	400	NA
						TOTAL	600	200	800	
Morrow Designs	Decision 1	Z80		5,000	7,000	04/81	100	40	140	NA
MultiTech Systems	MT 500	Z80		4,795	4,995	12/81	9	0	9	250
NCR	7500, 7900	NCR		7,500	9,500	--/79	1,600	3,200	4,800	NA
	Multivision	8085-A		3,700	12,800	12/80	450	450	900	NA
						TOTAL	2,050	3,650	5,700	
NEC Information Systems (U.S. Only)	205	NEC		6,500	11,039	07/80	580	-	580	NA
	PC 8000	NEC		995	2,300	05/81	14,000	-	14,000	NA
						TOTAL	14,580	-	14,580	
NNC Electronics	80	Z80		4,850	4,583	02/80	200	100	300	200
	80W	Z80		8,750	8,640	11/80	200	100	300	200
						TOTAL	400	200	600	400
North Atlantic Ind.	SBC-1 Shoebox	LSI 11/2		1,980	1,980	01/81	100	0	100	NA
North Star Computers	Horizon	Z80-A		3,945	3,909	12/77	24,000	6,500	30,500	NA
	Advantage	Z80-A		3,995	4,295	09/81	2,500	500	3,000	NA
						TOTAL	26,500	7,000	33,500	

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Northwest Micro-computers*	IVMS 85/P	8085		7,200	7,200	01/78	25	3	28	X
Odell Ind.*	System 85	8085A		10,450	15,550	06/78	30	0	30	X
Olivetti	P-6060	Olivetti		13,000	13,000	--/77	1,000	-	1,000	X
(U.S. Only)	P-6066	Olivetti		11,600	11,600	03/81	600	-	600	NA
						TOTAL	1,600	-	1,600	
Onyx Systems, Inc.	Sundance	Z80-A		8,495	9,000	06/81	400	200	600	1,200
	C5001/MU	Z80-A		8,400	9,000	04/81	600	300	900	1,300
	C8001/MU	Z80		10,500	11,000	10/80	1,000	700	1,700	1,800
						TOTAL	2,000	1,200	3,200	4,300
Osborne Computer Co.	Osborne 1	Z80		1,795	1,795	07/81	6,700	300	7,000	NA
Otrono Corp.	Attache	Z80-A		3,995	3,995	03/82	0	0	0	NA
Panasonic Co.	JD 850	8085		10,500	11,500	06/80	20	-	20	NA
(U.S. Only)	JD 740	8085		7,000	9,500	10/81	5	-	5	NA
	JD 800	8085		8,000	9,000	--/82	0	-	0	NA
						TOTAL	25	-	25	
Pentel of America, Ltd. (U.S. Only)	Penputer PS-850	Z80		13,000	13,000	2Q/82	0	-	0	NA
Pertec Computer Corp.	PCC 2000	8085A		9,995	13,120	09/78	1,469	1,565	3,034	NA
	MITS 300/25/55	8080		8,080	13,800	--/77	1,100	175	1,275	X
						TOTAL	2,569	1,740	4,309	
Polymorphic Systems	8813	8080		4,700	5,801	09/77	2,650	500	3,150	
	Twin Systems	8080		6,000	7,500	07/78	90	85	175	500
	88HD	8080		10,000	15,000	03/81	50	75	125	
						TOTAL	2,790	660	3,450	500
Processor Industry*	Sol I, II, III, IV	8080A		3,000	6,000	--/77	4,500	500	5,000	X
Psytek, Inc.	Psytek 770	Z80		4,750	7,200	07/79	30	5	35	X
Quay Corp.	Quay 900, 900M, 900/33	Z80		4,995	8,000	09/79				NA
	Quay 500	Z80		2,495	2,700	03/80	800	200	1,000	NA
	Quay 520	Z80		2,995	3,200	03/80				NA
	Quay 540	Z80		3,745	3,745	01/82	0	0	0	NA
	Quay 910	Z80		7,995	7,995	03/82	0	0	0	NA
						TOTAL	800	200	1,000	
R2E of America (U.S. Only)	X Product	Z80		8,500	8,500	01/79	250	-	250	NA
Rair Microcomputer Corp.	Black Box 3/20, 30, 50	8085		6,500	6,500	05/81	250	1,495	1,745	3,900
Retail Sciences	Clerk 300	Z80		12,000	12,000	08/79	85	50	135	X
Sanyo	MBC-2000	8085		3,495	3,495	05/82	0	-	0	NA
(U.S. Only)	MBC-3000	8085		6,495	6,495	06/82	0	-	0	NA
	MBC-1000	8085		1,995	1,995	05/82	0	-	0	NA
						TOTAL	0	-	0	
Scientific Data Sys., Inc.	SDS 420 Series	6502		5,500	8,400	03/79	467	30	497	800
	SDS 4000	6502		7,400	7,400	07/82	0	0	0	300
						TOTAL	467	30	497	1,100
S. D. Systems	SD 100	Z80		6,995	6,995	04/78	200	65	265	X
	SD 200	Z80		9,700	10,001	05/77	345	110	455	NA
	SD 700	Z80		19,500	20,684	09/80	70	25	95	NA
	SD 610	Z80		14,000	14,500	02/81	95	40	135	NA
	MS 200	Z80		6,495	7,500	02/81	50	20	70	NA
	MS 610	Z80		9,995	11,000	12/81	10	5	15	NA
	WS 800	Z80		2,495	3,500	02/82	0	0	0	NA
						TOTAL	770	265	1,035	
Sharp Electronics Corp.	YX-3200-100	Z80-A		4,495	5,000	05/81	200	0	200	NA
(U.S. Only)	YX-3200-200	Z80-A		6,525	7,000	01/82	0	0	0	NA
						TOTAL	200	0	200	
Smoke Signal Broadcasting	Chieftan	6800		2,595	3,000	03/79	500	135	635	50
	Chieftan	6809		2,695	3,100	03/80	650	275	925	500
						TOTAL	1,150	410	1,560	550
Solid State Technology	8185	8085A		6,000	10,000	12/79	150	25	175	200
Systel Computers, Inc.	Model 11	8085, Z80		8,950	8,950	01/81	50	200	250	X
	Model 15	8085, Z80		9,950	9,950	01/81				X

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Tandy/Radio Shack	TRS-80/I	Z80		499	1,000	09/77	247,500	27,500	275,000	NA
	TRS-80/II	Z80		3,450	6,500	07/79	72,000	8,000	80,000	NA
	TRS-80/III	Z80		700	2,000	09/81	34,000	4,000	38,000	NA
	TRS-80 Color	Z80		399	399	09/81	11,000	1,000	12,000	NA
	TRS-80/16	68000		4,999	9,000	--/82	0	0	0	NA
						TOTAL	364,500	40,500	405,000	
Tano Corp.	Outpost II	6800		4,995	5,575	08/78	1,050	130	1,180	NA
	Outpost 7	6800		3,000	4,000	08/77	180	20	200	X
						TOTAL	1,230	150	1,380	
Tektronix	4051	6800		5,995	12,500	12/75	9,060	4,840	13,900	NA
	4052	Tek		9,950	16,500	07/79	2,870	1,430	4,300	NA
	4054	Tek		20,100	22,500	07/79				NA
						TOTAL	11,930	6,270	18,200	
Televideo Systems, Inc.	TS 801	Z80		3,295	3,295	09/81	537	134	671	340
	TS 816	Z80		12,995	12,995	02/82	0	0	0	1,700
	TS 800A	Z80		1,695	1,695	09/81	1,018	255	1,273	13,000
	TS 802	Z80		3,495	3,495	12/81	56	13	69	6,900
	TS 802H	Z80		6,995	6,995	12/81	27	6	33	3,600
	TS 806	Z80		7,195	7,195	09/81	550	137	687	4,000
						TOTAL	2,188	545	2,733	29,540
Texas Instruments	99/4	TI9900		650	1,000	11/79	19,850	150	20,000	NA
	99/4A	TI9900		450	450	07/81	29,700	300	30,000	NA
						TOTAL	49,550	450	50,000	
Toshiba America (U.S. Only)	T-200	8085		3,750	5,500	08/81	200	-	200	NA
	T-250	8085		4,750	7,000	08/81	300	-	300	NA
						TOTAL	500	-	500	
Vector Graphics	System B, MZ	Z80		4,313	5,400	01/79				
	1600	Z80		3,995	3,995	08/80	10,921	2,814	13,735	NA
	2800	Z80		7,295	7,295	07/80				
	2600	Z80		5,195	5,195	03/81				
	3100	Z80-B		5,795	5,795	07/81				
	3105	Z80-B		8,495	8,495	07/81	1,118	182	1,300	NA
	3032	Z80-B		12,795	12,795	05/81				
	5032	Z80-B		13,995	13,995	02/82	0	0	0	NA
	5005	Z80-B		8,995	8,995	05/81	258	42	300	NA
	Memowrite	Z80		8,950	8,950	01/79	300	100	400	X
						TOTAL	12,597	3,138	15,735	
Victor Business Prod.	Victor 9000	8088		4,995	8,000	04/82	0	0	0	NA
Wang Laboratory	PCS 1	Wang 2200		5,400	8,000	04/76	840	320	1,160	X
	PCS 2	Wang 2200		4,800	10,145	04/77	3,045	1,960	5,005	X
	PCS 3	Wang 2200		6,500	9,000	04/80	25	10	35	NA
						TOTAL	3,910	2,290	6,200	
Wave Mate	Series 2000	6800		2,395	3,000	01/79	100	100	200	NA
Wicat	System 150	68000		8,500	8,500	10/81	125	25	150	225
	System 150-3WS	68000		10,850	10,850	04/82	0	0	0	1,250
						TOTAL	125	25	150	1,475
Xerox	510	8085A	c	15,000	17,000	09/79	1,500	2,500	4,000	NA
	515	8085A		5,700	6,300	03/81	400	2,000	2,400	NA
	820	Z80		2,995	4,995	06/81	10,000	2,000	12,000	NA
						TOTAL	11,900	6,500	18,400	
Zeda Computers Int'l	Zeda 580	Z80		6,038	6,250	06/79	500	250	750	NA
	Zeda 520	Z80		3,995	3,995	02/81	50	0	50	NA
						TOTAL	550	250	800	
Zenith	Z89	Z80		2,595	5,000	10/79	15,750	15,750	31,500	NA
	Z90	Z80		2,895	5,000	10/81				
Zilog	MCZ 1	Z80		8,000	9,500	--/77	1,750	1,550	3,300	NA
	MCZ 2	Z80		11,500	11,500	06/80	650	550	1,200	NA
						TOTAL	2,400	2,100	4,500	

	U.S.	International	World
TOTAL OF ABOVE	1,249,147	506,453	1,755,600
TOTAL OTHER VENDORS	5,450	1,250	6,700
TOTAL	1,254,597	507,703	1,762,300

NOTES:
a Corporate name was changed from Business Machines.
b Corporate name was changed from Ohio Scientific when it was acquired by M/A-Com Office Systems, Inc., 12/80.
c Xerox sells the 510 model in addition through Diablo under the Model 3000 name; however, the whole installed base is credited to Xerox.
* Not currently active in manufacturing or marketing desktop computers.
NA Data is not available.
X Model not in new production.

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"The Gray Sheet"

EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

MOLLY UPTON, EDITOR JUNE 21, 1982 ● VOL.18,NO.4 P.J. MCGOVERN, PUBLISHER

COMMUNICATIONS TECHNOLOGIES ABOUND, BUT USERS SLOW TO CHANGE NETWORKING HABITS

Despite the clear convergence of communications and computer technologies, their acceptance by the marketplace is proceeding at very different rates. Whereas new hardware such as word processors and desktop computers has been able to sustain rapid growth rates, advanced data communications techniques such as satellite transmission, packet switching, and local area networks are still largely relegated to the fringe of user experience.

This situation is not expected to change rapidly. In fact, if there was one phrase which best summed up EDP/IR's expectations for data communications over the next five years it would probably be "More of the same."

Reasons for this relative stability run the gamut from Bell system lethargy to internal squabbling inside large organizations. But the key causes are most certainly rooted in economics. Despite charges that Bell's monopoly incentives have served to hold back the market, the fact is that the available non-Bell alternatives have simply not proved very attractive; only the "plug-compatible" voice suppliers such as MCI and SPCC have compiled enviable profit records.

But although the next five years will still be dominated by the remote terminal networks of today, the market is preparing itself for eventual migration to new technologies later in the decade. Among some of the key factors:

- The technology of the nation's communications backbone will continue to be determined by voice and video needs; data communications will remain a small, but fast growing sector.
- Debate over the proposed Bell settlement has released an air of uncertainty that could last another five years, further complicating the user's decision-making process.
- The rapid installation of desktop computers and their use by managers and professionals may spur new demand for packet switching, local area networks, and voice/data PBXs.
- Integrated voice and data nets will be slow to emerge due to economic, organizational and optimization concerns.

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THE PROLIFERATION OF INFORMATION DEVICES
(Copyright 1982 -- International Data Corporation)

Device	1981 Installed	1986 Installed
Mainframes	61,000	82,000
Minis/Small Business Computers	600,000	1,700,000
Desktop computers	1,200,000	14,600,000
Word Processors/ Elec. Typewriters	1,000,000	5,200,000
Terminals	6,900,000	17,000,000
SUBTOTAL	9,761,000	38,582,000
Residential Telephones	130,000,000	145,000,000
Business telephones	55,000,000	70,000,000
Televisions not on cable	60,000,000	50,000,000
TVs on cable	20,000,000	40,000,000
SUBTOTAL	265,000,000	305,000,000

The numbers suggest that despite the rapid growth of markets such as desktop computers and office automation, voice and video products will remain the dominant receivers of U.S. communications services. The Bell system will always be geared to voice, and satellite and cable channels are ideal for video; in both cases, data traffic is looked upon primarily as an after thought. Indeed, the entire data communications equipment market has but 3% of the $75 billion U.S. telecommunications industry, and data communications line charges represent less than 15% of business phone service.

Business as usual

Despite the growing number of alternatives, most computer networking is still done at relatively slow speeds (less than 4800 bps), using unsophisticated protocols (over 40% asynchronous), and in host-based star networks. A recent IDC survey of 300 companies using over 100,000 terminals showed that 80% were using basic point-to-point networks, and that nearly 70% were point-to-point from a single host. 88% used a single vendor for their hosts; and only 4% used a public network for data transmission.

U.S. REMOTE TERMINAL DEMOGRAPHICS -- 1981
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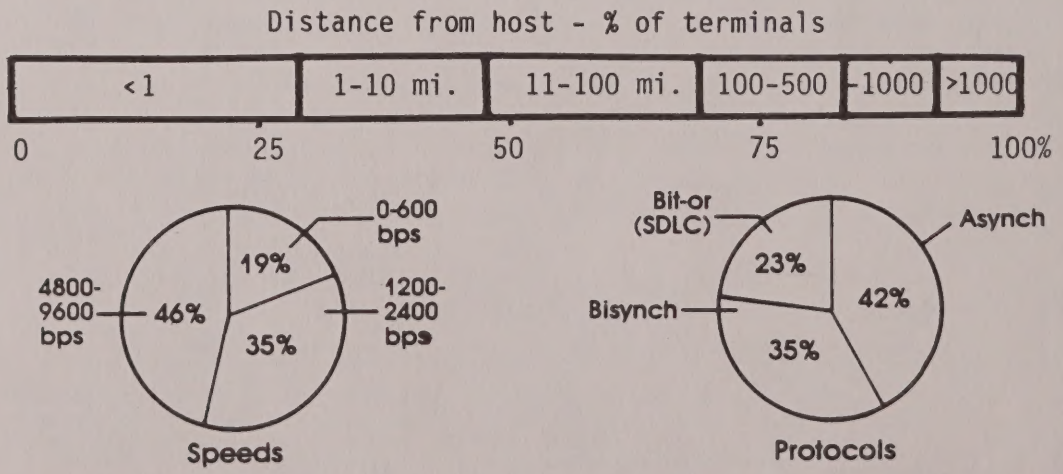

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Economic reasons are not the only cause of this situation. Users of communications services are generally operating from within organizational structures ill-equipped to deal with information processing technologies. The ability of organizations to muster their resources and provide interdepartmental powers will usually lag behind end users' desire to hook devices together. Although some DP managers do control voice spending, as a rule DP managers will build data networks and administrative groups will worry about voice; when it comes time to buy a product of mutual interest, i.e. a PBX, the voice of the largest constituency will usually win out.

Thus numerous incompatible networks have sprung up in large organizations, and will continue to do so. By the time top management is ready to integrate them, it will have to contend with a considerable investment in the status quo. This organizational problem is not likely to change quickly and thus dedicated networks, perhaps connected by gateways, will persist for some time.

A study by Bolt Beranek, and Newman indicates that this segmentation may in fact be for the better. Its work suggests that the traffic patterns in a typical office might well work against the ideal of integration; because of throughput considerations, any such network would have to be geared to voice needs. Their findings are presented below:

AVERAGE BUSY HOUR THROUGHPUT (Kbps)

	Small Office	Medium Office	Large Office
Voice	1600	8000	32000
Interactive Data	2	17	67
Facsimile	8	40	160
Copier	7	34	140
Printer	14	70	280

Source: Bolt Beranek, and Newman, based on internal data

Bell view, products and politics

By reducing AT&T's asset base by nearly two-thirds, the settlement, if it goes through, will increase the company's incentive to bring out new products and technologies since it will need them to grow. The Bell Packet Switching Service (BPSS) and an enhanced Dimension PBX designed for both voice and data switching have already been announced, and a digital PBX (Antelope) is said to be on hold due to political reasons.

From the initial tariff filed in March 1982, AT&T's BPSS appears to be a high end packet service geared to very large organizations, most likely as a delivery vehicle for Baby Bell's Advanced Communications Service. The proposed rates are too high to be aimed at direct competition with existing value added carriers such as Tymnet and Telenet, although this situation may well be temporary. After much speculation, Baby Bell (or XYZ Corp.) has been blandly dubbed American Bell. Current assets are $59 million; $570 million by 1985.

AT&T has just made some interesting changes to its Dimension PBX line. It has added a data switching capability so that sending data does not tie up the user's phone; this is not that unusual except that the Dimension is an analog not a digital PBX. The Dimension also has a shared modem capability that attaches the modems to the PBX instead of to the end user terminal.

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As for the state of the proposed settlement, 8,000 pages of comments have been filed with Judge Green who has evaluated them and has asked for a lot more information through 17 pages of specific questions. The settlement is far from home free, and given the number of lawyers and consultants making a living off it, EDP/IR doesn't expect a quick resolution. Bell is also making a big, but as yet unsuccessful, push to block the legislative effort, especially HR 5158.

Are desktops key to network future?

By 1986 the number of desktops installed in the U.S. will top 14 million and their need to tap data bases, share peripherals, and tie into mainframes will provide new communications incentives ... giving a boost to the demand for packet switching, local area networks (LANs), and voice/data PBXs.

Consider packet switching. The industry is now more than ten years old. In that time growth has come slowly and profitability has proven difficult. Telenet is still losing money; Tymnet is doing a little better since its service is often tied in with its computer services business. EDP/IR estimates that the entire public packet network market in 1981 was about $250 million.

But as the packet nets look to the future, they see some contradictory and troublesome signs. The percentage of remote terminals that are asynchronous will fall from 40% in 1980 to 30% in 1986, although a near tripling of the terminal base between 1981 and 1986 will help offset this. Since packet nets are most economical for slow speed terminals, a preponderence of intelligent and remote batch terminals will have a negative impact.

At the same time, the industry will also have to deal with a major influx of new competitors. In addition to AT&T, three major service bureuas -- Automatic Data Processing, Compuserve, and United Computing Systems -- have opened their nets to the public, and General Electric Information Services Company's 600-city Mark III net may follow. AT&T will eventually add computing power to its net (through Baby Bell), leaving only Telenet as pure public carrier.

Why all the attention? Certainly one reason is that it is easy for a service bureau to offer public access to existing facilities. But more importantly, the carriers are hoping that desktop computers will spur new demand for services such as third party data bases, graphics, electronic mail, and executive workstations with links to mainframe data bases and decision support systems. A 3270-type terminal performing a dedicated application can justify a leased line, but irregularly used desktops operating in a start/stop mode are well suited to packetized transmission. The profitability of the value-added carriers may well be determined by the growth of this office automation market.

Local nets

As with robots and desktops, local area network announcements seem to come at a pace of more than one a week. EDP/IR has counted more than 40 vendors aiming at the office automation, distributed processing, desktop, mainframe, and automated factory LAN markets. Products are being designed well before any standards appear, assuring the development of many incompatible systems.

With the exception of Datapoint, the market has proved reluctant; Xerox has "several hundred" non-Xerox Ethernet installations, but expects "substantial shipments over the next 12 months." Internally, Xerox has more than 3,000

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workers on Ethernet. Wangnet is still in the test site stage, and the LANs of other key computer vendors have yet to be fully brought out. Nestar, Corvus and others have had some success at the low end; Corvus claims 3,500 networks. One cause of user delay is that reasons for installing local nets have been drowned out by the baseband vs. broadband din which argues about video, costs, distance, and speeds, but doesn't do anything to sell the LAN concept itself.

EDP/IR sees local nets as primarily an administrative tool. Users won't be able to do anything they couldn't have done before through coax or telecommunications, but LANs make it easier, faster, and ideally cheaper to move devices around or add new ones without getting tangled in miles of dedicated cable. Though these benefits are considerable, they are hardly the panacea of integrated computing that Wang and Xerox once claimed, and the costs of rewiring can be high. The market is confusing, and probably won't clear up until IBM and AT&T are heard from; IBM has proposed a token passing standard, but a commercial product has yet to hit the market.

But desktop computers could provide the market with needed momentum. Given the trend toward distributed intelligence, there will be an increase in the demand for shared storage and printers, and network devices will be moved, added and deleted with more frequency. Occasional access to mainframe and mini data will also be needed, and there are already lots of products promising smooth ties between desktops and mainframes, an activity sure to continue.

Nevertheless, don't expect local network installations to take off dramatically. New buildings should be wired for either baseband or broadband, but most are not, and new construction is down to a trickle. Retrofitting has its price, and users must decide whether the hard-to-define paybacks are worth the considerable costs of equipment and installation. Additionally, most of a desktop user's needs can be met through a PBX-based solution.

The PBX alternative

PBXs can offer a local network solution that allows the use of existing wiring while featuring potential low cost and ease of connectibility; telephone wiring is also cheaper and easier to work with than coax. Digital data can travel on telephone wiring at speeds up to 64Kbs, sufficent for most applications other than video and inter-mainframe traffic.

This has led some to see the PBX as a sensible network solution and many PBX vendors are showing interest in the workstation area. But once again trade-offs exist. Unlike the bus architectures of cable based LANs, PBXs require switched, dial-up connections, and network interface costs are still fairly high. The new Bell Dimension data switching feature goes for $46/month, and Rolm's data communication feature costs $600 to $900 per station. As noted earlier, PBX buying decisions will be based on voice criteria.

Fiber optics market yet to blossom

Though the market for fiber optic communications has lagged behind the hopes of a few years ago, many observers are still optimistic. Optical transmission is expected eventually to be important in computer, telephony, video, energy, and automotive applications. According to Kessler Marketing Intelligence, the market for fiber optic wire and equipment was about $66 million in 1981, and will reach $540 million by 1986.

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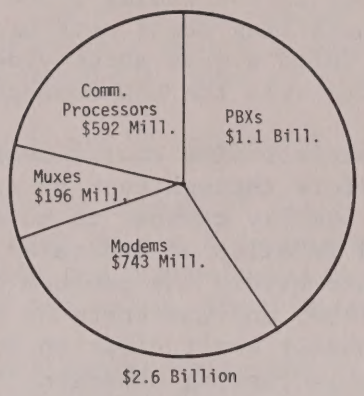
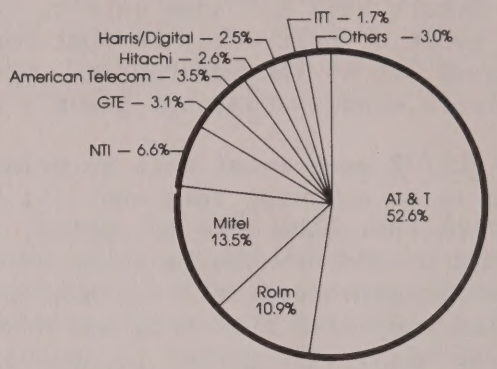
1981 SHIPMENTS -- U.S. COMMUNICATIONS EQUIPMENT MARKET



$2.6 Billion

1981 PBX MARKET SHARES BY LINE SHIPMENTS



Total Shipments = 3,250,000 Lines

Recently NEC unveiled a fiber optic local net that can operate in a loop, branch, or star configuration, supporting standard communication interfaces. NEC says that fiber allows its C&C-Net to simultaneously support image, voice and digital data transmission, something it claims broadband vendors are finding difficult. C&C-Net is scheduled to hit the U.S. market sometime in 1983.

Satellites for the long haul

There are currently about a dozen communications satellites with some 200 transponders available for domestic use; this capacity should double by 1985 resulting in significant excess capacity. IDC calculates that about 35% of the transponders are for voice, 32% for video, 3% for data and 30% for back up. Currently there are four key players: Comsat General, Satellite Business Systems, Western Union, and RCA Americom; Southern Pacific Communications, GTE Satellite, Hughes Communications, and AT&T have FCC approval to enter the fray.

Data applications have been limited. Even Satellite Business Systems (the joint venture between IBM, Comsat, and Aetna) has not radically changed users' datacom habits. Response appears favorable -- by end year SBS will have about twenty customers who expect to have about eight earth stations each by 1984 -- but the traffic is predominantly voice. IDC estimates that at the end of 1981, SBS was handling 1 million calls/month.

As for data, despite the advertised 1.5 Mbs speeds, most users are communicating at 56Kbs, focusing on multiplexed slow speed traffic rather than applications requiring high bandwidth. There have also been problems with propagation delays and protocol conversion. Teleconferencing is a viable option, but it now appears that the near term future of SBS lies with voice service.

DOMESTIC SATELLITE TRANSPONDERS 1981-1984
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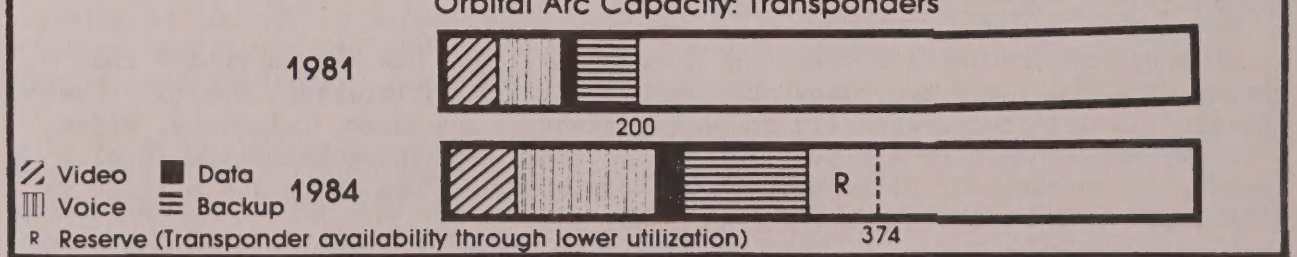

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SMALL SYSTEMS REIGN AT NCC; SHOW TAKES ON OEM FLAVOR

NCC 1982 in ten words or less: Houston. June. Big. Hot. Desktops. Printers. Disks. OEMs. Office. Japanese.

NCC 1982 found the gathered masses looking at small systems and office applications. As might be expected, the IBM booth was a perfect reflection of the tone of the show. Big Blue surrounded an inner core of Displaywriters, Datamasters, and Personal Computers (with a System 38 thrown in as an afterthought) with a shell of new technologies from the R&D lab. By far the biggest attention-getter was a 10" x 13" high resolution plasma display -- 72 pel/in. and a 6 Mbit/sec data rate -- along with a discussion of Josephson Junction technology and a cut-away model of the thermal conduction modules first used in the 4300s. Rarely was the crowd less than five deep.

DEC's booth also had a small systems flavor, drawing big crowds to gawk at its new line of personal computers. Ken Olson's brainchild was also displaying a penchant for high-powered marketing, passing out truck-loads of highly informative books entitled "Guide to Personal Computing," replete with order coupons. Also being cast to the winds was the "Digital Monitor," a newspaper offering more of the same.

Japanese vendors and attendees were out in force. NEC, Hitachi, Fujitsu, and Toshiba all had large, well positioned booths featuring a dizzying array of small systems and printers. Other NCC trends of note:

- Drawing the bulk of the interest from attendees were desktops, many with dual 8- and 16-bit processors and multiple operating systems.

- Multi-user vendors such as Altos, Vector Graphic, North Star, Wicat, Plexus and the like were on hand, targeting the traditional market for low-end minis and SBCs. The drive is to get the cost down to $2,000 per workstation.

- Concurrent with the proliferation of small, single user systems, has been a flurry of activity in small Winchester drives. Capacity can now reach 100 MB, according to yet another venture capital baby, Evotek, which announced a 50 MB model.

- There was a marked increase in the number of near letter quality (NLQ) matrix printers, as well as laser printers, with Canon, Hitachi, and Ricoh sporting new models, along with Xerox, which had a whole booth dedicated to non-impact technology.

An informal poll of big systems exhibitors did not find a great deal of discontent with the small systems emphasis, however. Most were pleased with the quality of attendees visiting their booths, and felt good about the number of serious leads generated, even if traffic appeared comparatively light to that generated by small systems vendors.

Several said that a pre-show promotional pitch to area prospects through their sales forces and via the mails was very effective in drawing qualified prospects. A few indicated that they felt the $300,000-$500,000 cost for a booth was not well spent and are strongly considering pulling out next year.

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Desktops mix it up with the big guys

In 1978, when NCC was held at the Colliseum in New York, desktops were relegated to a separate exhibit at a nearby hotel. Only a few vendors -- Apple, Vector Graphic, and Northstar -- were in the big hall, and only the first two appeared to be purposefully selling to business. Nevertheless, it was at this show that the first signs of the business sector bonanza could be observed. Five years later, not only have desktops become legitimate contenders for the business dollar, but they dominated the show.

Every Japanese vendor -- Hitachi, NEC, Toshiba, Fujitsu, Sharp, Sony, Sanyo, Canon -- had a desktop, generally priced a little under their U.S. competitors. Ditto for Olivetti. Apple, across the aisle from IBM, and especially Fortune, drew thick crowds. Others were taking their cue from DEC which added a CP/M board to its VT100 -- Univac and Harris offered CP/M options to their terminals with mainframe file compatibility while Beehive added CP/M. Expect more of this in the future, further blurring the distinction between desktops and terminals.

New disks offer more capacity, lower $/M Byte

Spawned of venture capital from Rothschild Inc. and The Hillman Co., Evotek out of Fremont, CA introduced a family of 5.25 in. drives with up to 50M byte capacity on four disks, while touting a cut in $/M byte to about $40/M byte ($2,125 in OEM quantities of 1,000). Irwin International announced the 516, featuring a 16 M byte platter and 30 msec access time. Sony had a 3.5 in. micro-floppy drive; Hitachi a 3 in. micro drive (it fits in a pocket, but is it permanent press?).

U.S. efforts to standardize micro-floppies for size, media compatibility, and packaging are being led by Dysan, Shugart, Tabor, and Verbatim but are so far being resisted by the Japanese.

CDC, which holds the lion's share of the 14 in. drive market, introduced a 5.25 in. "Wren" model for the OEM market as well, offering up to 32M byte capacity. The Wren uses the same technology as CDC's 3375-type device: 3,600 rpm, 50 msec average access time, and 7.8 Mbit/sq. in. density. In all, CDC introduced seven disk and tape products for the OEM market, ranging from the Wren to an 8 in., 160M byte successor to the mini module drive. CDC's Peripheral Products Division is well on its way to becoming a $1.5 billion company, up from $1 billion a couple of years ago. The company stressed the advantages of leveraging one set of technology across a wide range of products.

But the end user news from CDC was tucked away in a hotel room: CDC's 3380 and 3375 look-alikes were side by side with an IBM 3380. CDC said a good part of the trick in making its 33800 was to use 150 mil substrate, quite a switchover from 75 mil. CDC uses sputtering to put the coating on the disk, in contrast to start-up Ibis, which uses electroplating. CDC emphasized that it makes its own thin film heads and is jointly investing $42 million in a facility with Memorex; CDC anticipates that plant will increase its thin film head production from 400,000 to 5 million heads per year.

CDC plans to start volume shipments of the 33800 by the second quarter of 1983 and anticipates announcing the 3375-type device during the third quarter of 1982 with delivery about six months later.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

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MOLLY UPTON, EDITOR JUNE 1, 1982 ● VOL.18,NO.3 P.J. MCGOVERN, PUBLISHER

New architectures, 32-bit chips coming -- Page 4

MICROPROCESSOR VENDORS VIE FOR DESIGN CONTRACTS; NATIONAL SEMICONDUCTOR ENTERS 16/32-BIT FRAY

Once limited to the arcane realm of product specifications, competition in the microprocessor market now includes its fair share of marketing hype. Factors such as company image and product momentum have become critical to vendor's selection process -- a leap of faith loaded with long term implications due to the rising importance of desktop computers.

Unlike the memory market where standard products compete mainly on price, quality, and availability, microprocessor (MPU) selection is a delicate blend of weighing what's available now with what's coming in the future. Today's leader plays catch-up tomorrow, as endless rounds of feature one-upsmanship and claims of fastest and cleanest fuel an engineering and media war that is reshaping the semiconductor business. Among the key forces at work:

- Big stakes. Microprocessor sales have long coat tails, pulling in sales of peripheral chips at an estimated 10:1 ratio. In addition, Motorola expects the annual worldwide market for just the 16/32-bit MPUs to reach $1.5 billion by 1987.

- A systems orientation. Motorola -- through its acquisitions of Codex and Four Phase and its new packaged 68000-based microcomputer system -- National with a new Microcomputer Systems Division, and Intel with several packaged products have joined Texas Instruments, and to a lesser extent Zilog, in the computer systems business.

- Converging interests. As companies like Digital Equipment and Data General bring their operating systems down to desktop sizes, the interests of large MPU and mini and mainframe vendors become more alike. There are even reports that IBM is serious about putting its 370 architecture on a chip, the so-called 4311.

- Design wins. As Intel has shown, hitting the market before the competition can help court crucial vendor support.

- 32-bit chips. Samples will start appearing in late 1983.

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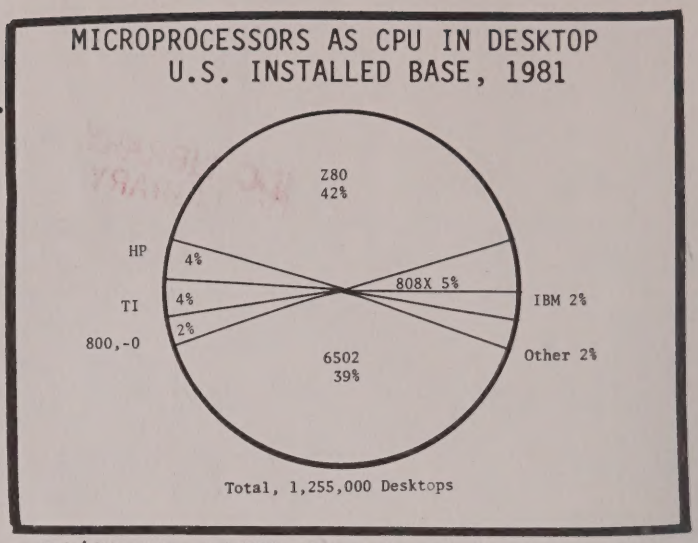
As a new generation of chips emerges, the competition is coming down to a battle for design contracts. Intel with its 16-bit 8086 certainly has the volume, but Motorola and its 16/32 bit 68000 has the momentum and is now believed to be getting more than half the new designs. Zilog's Z-8000 is used primarily in the word processing, military, communications, and peripheral markets, but it is being used in Olivetti's new desktop and others will be announced. TI's 99000 is aimed mostly at the controller market.



National Semiconductor with its new 16/32 bit 16000 line is trying to make its presence felt in the market with a theme of "a little late, but a lot better," and since 32-bit chips will carry the industry through the decade, the company believes the lion's share of the market is still up for grabs.

National describes its approach as top down, looking at the functions of IBM/370 and Vax architectures and then putting them on silicon. This "micro-mainframe approach" includes virtual memory, separate floating point and memory management chips, and a full line of peripheral components. In time all memory management and floating point power will fit on a single processor chip as is the case with the recently announced Intel 80286.

The 16000 family consists of 8-, 16-, and 32-bit data path versions of the core design. The three MPUs (16008, 16016, and 16032) are all virtual machines and each supports the same peripheral chips. The demand page virtual memory resembles that used on Vax and 370 machines as opposed to the segmented schemes used by the 8086 and 68000, but Motorola and Intel have also been actively improving their memory management.

According to National, the 16000 line is 10%-20% faster than the 68000 (taken with a grain of salt given MPU claims), but it adds that its virtual memory, ease of upgradeability, efficient support of high level languages, and eventual conversion to low-power consumption CMOS technology are its main advantages. The 16000 family of chips will be made available over the 1982-83 timeframe, meaning that 16000 users will in all likelihood not hit the market in force until 1984. Despite this late start National hopes to get 20% of the market by 1986, believing that Intel will be slow to show a 32-bit product.

32-bit semantics

Adding to an already shrill debate, National boasts that it has the first true 32-bit system on the market, but this is a matter of definition. There are generally two ways of categorizing whether a system is 32 bits -- hardware and software. There seems to be an emerging consensus that in order to have true 32-bit hardware, a system must use a 32-bit data path. Currently no one is expected to offer this until the third quarter of 1983. National and Motorola both support 32-bit software and both have 32-bit registers, but National has 32-bit Arithmetic Logic Units (ALUs); this is the basis of their claim. Intel, Zilog and Texas Instruments are still using 16-bit technology.

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WHO'S USING WHOM

Motorola 68000	Intel 808X	Zilog Z-8000	Tex. Instr. TI99000	Nat. Semi. 16000
Tandy	IBM	Olivetti	Pertec;	Datapoint
HP	Wang	Paradyne	TI would	Applicon
Apollo	Convergent	Computer	not reveal	Acorn
Fortune	Technologies	Consoles	others	
CIE Systems	Altos			
Codata	Grid			

(Burroughs, NCR, and Savin are using Convergent Technologies gear; Control Data is expected to use workstations by Altos.)

Details of the 16000 announcement are perhaps most significant for what they say about the MPU industry. Second sources, software support, and design momentum are all dependent upon marketing issues. Some examples:

- A link with Fairchild. Fairchild will design many of the peripheral chips and is also heavily involved in the software, testing, and marketing operations. This "unprecedented cooperation" is recognition of the importance of second sources and part of a general trend to farm-out peripheral chip development costs. Eurotechnique will also second source the 16000.

- Software development on Vax, under both VMS (now) and Unix (later).

- A raid on the Intel 8080 base. National's 16008 and 16016 feature 8080 object code compatibility in addition to native 16000 code, thus allowing 8080 users to migrate over to the National line. And Datapoint (whose current systems use 8080 Intel chips) is doing just that -- the 16000 will be in a series of products scheduled for release near the end of '83.

- Other design wins. Applicon will answer Apollo's challenge with a low-cost 16000-based CAD/CAM workstation. (Applicon and Fairchild are both Schlumberger companies.) Other users include Acorn (a British desktop firm) and Dietz in Germany.

- Software supporters. Translation Systems, Digital Research, Ebnek, Tecsi, Hunter and Ready, and Whitesmith will provide various compilers and operating systems.

The race to 32-bit systems

The 10-year history of the MPU industry has seen many innovations, but recently the pace of change seems to have accelerated. It was only 5 years ago that the Apple II was introduced and already the infant 16-bit market can see the signs of impending obsolescence.

National says that it will sample its full 32-bit 32032 in the second quarter 1983; Motorola will sample its 32-bit 68020 in the fourth quarter of 1983. Zilog's 32-bit system (Z8000) is also scheduled for next year. Texas Instruments already has 32-bit ALUs, but not in its 99000; Intel has its 432 and will have a 32-bit follow-on to the 8086.

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NEW CPU ARCHITECTURES, FABRICATION TECHNIQUES BEING INVESTIGATED

As trends evolve toward stuffing more capability into smaller boxes, and more functionality on chips, designers' thoughts turn to different techniques and architectures as well as fabrication and packaging. Some of the trends:

- New plans for CPU architecture, with the emphasis on single-chip, 32-bit systems designed for use with high level languages (HLL).

- Manufacturers' efforts at denser fabrication of chips, many of which can be produced on current production lines, and packaging including a multilayer chip carrier that helps create a 370 the size of a wallet. Bell and HP improved their 32-bit chips -- Bellmac 32A and "Focus."

Architecture philosophers come from two camps: manufacturers and universities but both are investigating designs intended for use with high level languages. The philosophy seems to be that VLSI design needs and merits simple, and thus expeditious hardware design. Complex functions tend to be thrown into software, such as compilers, where the overhead will be incurred once rather than during many instructions.

Whereas last year the Intel 432 object oriented three-chip set micro generated much wind and ink, this year the topic is fast micros based on the concept of reduced instruction sets and capable compilers. This year most of the discussion on other architectures comes from universities, with the exception of IBM's 801, which is portrayed as an R&D effort and not a product.

HLL Designs

There are three basic microprocessor development efforts that share some principles such as the use of reduced instruction sets and dependence upon capable compilers. The reduced instruction set computer (Risc) is being developed at University of California, Berkeley; the microprocessor without interlocked pipe stages (Mips) at Stanford; and the 801 was developed at IBM's Thomas J. Watson Research Center in Yorktown Heights, New York. The university chips are NMOS whereas the IBM device is emitter coupled logic (ECL). The university chips were described at the IEEE Computer Conference, while IBM presented a paper on the 801 at the ACM Architecture Conference.

The Risk system in single chip form isn't yet a reality because of fabrication problems. Benchmarks indicate the Risc chip is at least as fast as a Vax 11/780 if not faster.

Whereas the Risk system concept emphasizes the use of a large number of very simple instructions -- all equal to one word and executable in one machine cycle, the Mips system's instruction set is not as straightforward and needs more sophisticated compilers to help it achieve high performance. Thus the complexity is shifted from hardware to software, where the overhead is incurred once during compilation.

The Risc system has several, overlapped sets of registers, thus giving it a typical call time of 2- vs. 20 microseconds for a typical call on a Vax 11/780. Accesses to data memory are cut by a factor of two, designers claimed.

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Stanford's Mips machine is designed as a general-purpose architecture that gives high performance through execution of compiled code. The Mips design handles an instruction set that is a compiler-driven encoding of the micro engine. Although the processor is pipelined, software provides the pipeline interlock functions. Its designers expect its execution time to be substantially faster than the Motorola 68000.

IBM's Experimental 801

The concepts behind IBM's 801, in addition to the use of high level language and a sophisticated compiler, are a primitive instruction set that can be hardwired and a storage hierarchy (cache) and I/O organization that enables the CPU to execute an instruction at almost every cycle.

The 801 project, begun in 1975, has yielded a prototype that runs at an average of 1.1 cycles per instruction in some tests compared with 1.7 cycles per instruction on a 370/168. The 801 has spawned a second generation research activity based on "an understanding of many design mistakes," according to a paper by George Radin of IBM. There are three major principles of the 801 design:

- A CPU that can execute instructions in one relatively short machine cycle and define those instructions to be a good target for compilation so the resulting pathlengths are commensurate with those for the same functions on more complex instruction sets.

- Storage hierarchy architecture, CPU instructions, I/O architecture and software designed so the CPU will usually not have to wait for storage access.

- A pervasive use of the compiler gives the project freedom to change the architecture with the cost generally limited to recompilations.

The 801 gets instructions from an "instruction cache" which gives the performance characteristics of vertical microcode. The designers advocated programming complex functions as software procedures or macros rather than putting them in microcode: "the CPU is interruptible at 'microcode' boundaries and thus more responsive"; an optimizing compiler can often separate these functions' components; and some "parts of a complex instruction can be computed at compile time." Within the constraints of a primitive data flow, the designers left actual definitions of instructions to the compiler writers.

Some possible hints about IBM's future plans for caches may be gleaned from the 801. There is overlapped access to the cache between instructions, hardware synchronizing among the caches and I/O, and techniques to improve the cache hit ratios. (Add to this IBM's announcement of R&D design techniques that facilitate creation of faster, denser bipolar memories with a 30% reduction in power consumption via the use of a transient selection scheme. These new memories could be handy if IBM were to design microprocessors with dispersed caches on the chips.)

Radin highlighted an underlying strategy being "pervasively applied." Namely, wherever there is a system function that is expensive or slow in all its generality, but where software can recognize a frequently occurring degenerate case (or can move the entire function from run time to compile

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time) that function is moved from hardware to software, resulting in lower cost and improved performance.

Various software strategies optimize the cache effectiveness such as explicit instructions for cache management. Control program service programs "get their temporary areas from the same stack, resulting in much reuse of cache lines and, therefore, higher cache hit ratios." Focusing on the compiler capabilities, Radin said "the compiler for the 801 has demonstrated that it can produce object code that is close enough to best hand code generally so that assembly language programming is almost never needed for performance."

The ability to preserve source code while changing the architecture can have "significant long range impact on systems. New technologies (and packaging) often offer great performance and cost benefits if they can be exploited with architecture changes," Radin observed.

Another element offering future changes was packaging interrupt determination and priority handling in a special unit called External Interrupt controller outside of the CPU so other versions can have different interrupt strategies without impacting the CPU design. Copies of proceedings of ACM's Symposium on Architectural Support for Programming Languages and Operating Systems cost $18 from ACM's order department, Box 64145, Baltimore, Md. 21264.

Fabrication progress

In other developments, Bell and IBM have chalked up some fabrication advances, some of which can even be run on existing production lines:

- Bell Labs' 256K random access memory, although it requires some new processing techniques, can be manufactured with equipment already in place at most semiconductor manufacturing facilities, Bell claimed. Western Electric is scheduled to make these RAMs later this year.

- IBM's experimental 288K bit dynamic RAM stores four times the data in about twice the area as its 72K bit chip and has been made on the same line as the 72K bit chip. A parallel mode of operation helps add speed that helps compensate for the density which IBM said often means slower performance. The denser chip has an access time about half that of the 72K bit chip.

- IBM is manufacturing on its standard lines a denser version of its 64K bit RAM that is 62% the size of IBM's original 64K device. The smallest geometric features on the chip are 2.2 micrometers wide, so IBM can put 240 (rather than 145) chips on a 4 inch wafer.

In other developments, IBM has created a 72K bit bipolar chip that is 12 times as fast as the current IBM 72K bit chip which uses field effect transistor technology. Access time is 50 nsec compared with 600 nsec for the FET based chip of the same size. Previous to this, IBM's largest bipolar chip was one having 2,304 bits that IBM makes for high performance applications.

A custom bipolar chip with an embedded read only memory and the equivalent of 4,208 logic circuits, many of which are in 14 programmable logic arrays, contains about as many logic circuits as a 360/30. The basic circuits are diode-diode logic, which are small and use little power. In contrast with

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gate array designs, the customized chip uses all available logic devices and has straight, short interconnecting lines. And we can expect more use of programmable logic arrays now that IBM has developed a technique that reduces design time and provides better density without impairing the PLA's performance.

370 in a wallet

In packaging, IBM has an experimental technique using a nine layer ceramic substrate as a pluggable chip carrier that enables a "370 mainframe" to be "reduced to the size of a wallet." This new pluggable ceramic chip carrier greatly reduces the number of connections by placing all logic functions on one package; thus connections are eliminated between logic chips and are needed only to link the logic chips with memory chips, the terminal, and the printer. Instead of modules and cards, there are only pluggable cards. IBM first started using multi-layer ceramics in 1979 with the 4300 series.

It seems likely this technique will soon be used; IBM reports good yields and notes that when one side is unusable, the carrier's other side can be used in single-sided applications.

This pluggable chip carrier can be used in two types of applications. For logic elements, a single module 86 x 63.5 millimeters can include the data flow of a 370/138 including CPU, I/O processor, basic system memory interface, data mover, and support read only memory chip. The card holds four, 5,000 circuit logic chips and nine 4K x 18 read only memory chips and dissipates 26 watts of power through a ceramic finned cap.

For memory a 63.5 millimeter square module can carry 144 memory chips and 18 support chips, using both sides of the module. A module can handle 1M byte memory with 64K chips or 4M bytes with the experimental 288K chips.

The 32-bit lineup grows

Bell Labs made news with an improved version (four times the performance) of its 32-bit single chip microprocessor with nearly 150,000 transistors. The complete redesign and fabrication occurred in just 13 months. The Bellmac 32A is operational within a laboratory system, will be in full scale production by yearend as a "key element in providing people with Information Age services."

The Bell microprocessor uses complementary metal oxide semiconductor (CMOS) technology and features 2.5 micrometer design rules vs. 3.5 on the previous chip. Its internal design is a full 32 bits -- with every data and address bus having 32 lines. And every CPU register holds, and every instruction can operate directly on, 32-bits. The architecture design incorporates features to efficiently support sophisticated operating systems such as Unix and high level languages such as C. The 32A embodies many of the principles described for other high level language processors. Benchmarks running it at 3/4 of its 32 MHz clock rate indicate it has about the power of a VAX.

Hewlett-Packard plans to have a product before March 1983 using its VLSI technology embodied in its 32-bit CPU and several new chip sets. All chips use 1 micron NMOS-III technology and are three to eight times denser than today's processors. The CPU and system RAM contain 450,000 and 660,000 devices respectively. A 32 bit internal data bus has a transfer rate of 36 Mbyte/sec.

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• HP TO USE SONY 3.5" FLOPPIES. Hewlett-Packard will buy some $30 million worth of Sony microfloppies over the next few years, and says it will use them in a variety of products. HP thus becomes one of the early U.S. customers for the new disks that hold 437K bytes of data per side. Unlike floppies, which use vinyl jackets, Sony uses a rigid plastic case which is said to provide better protection from dirt and dust, is easier to mail, and allows the users to write directly on the label.

• SONY ENTERS DESKTOP RACE with a Z80A-based system that has an 8086 option. The highly modular SMC-70 system uses the microfloppy disks with an option of 8-in floppies and a Winchester. A 64K, Z80A system with screen, keyboard, and dual microfloppies costs about $2,950. The 64K CPU box costs $1,475 and includes an additional 38K of graphics memory and a separate 32K system memory and has a resident interpretive Basic extended for graphics. Sony formed a new Microcomputer Products Division for marketing and support.

• UNIVAC TAKES EASY ROUTE TO DESKTOP; ADDS LOW END 1100/60. Taking a page from the DEC VT-100 conversion, Univac is offering a $250 CP/M upgrade to its 8080-based UTS 40 terminals and voila, Univac has its first personal computing product. Existing terminals can be upgraded in the field and first customer shipments will begin in October. Univac has also introduced the 1100/61 B1 which it claims is 25% more powerful than the IBM 4331-2; the new machine gives a low-end lead into the 12-model 1100/60 series. A minimum price for a 512K system is $236,519. First customer deliveries will begin in September.

• HOW FAR CAN MINI WINIS GO? In a capacity race that seems to change weekly, Evotek Corp. (Fremont, CA) claims to have a 5.25 in. Winchester that can store 51.6M bytes. The product will be available in the third quarter.

• DEC SLASHES MEMORY PRICES. Vax 11/780 main memory prices have been cut 60% to $5,500/M byte before OEM discounts. Coming behind its aggressively priced line of personal computers, its new low end Vax, and aggressive OEM board pricing, it looks like DEC is upping the ante for its competitors. Prime also cut memory prices -- add on memory for the 50 series was cut 53% from $36K/Mbyte to $19K/Mbyte. Prime also cut prices on some systems, for example, the 2 Mbyte 750 dropped from $180,000 to $173,000.

• IBM TAKES SERIES/1, DATAMASTER TO OEM ROUTE. As expected IBM is steadily pursuing all markets through all channels of distribution. After some modest OEM experimenting over the last year, both the Series/1 and the Datamaster are now being pushed aggressively with discounts of up to 30%. It is also holding special OEM (value-added remarketer) seminars around the nation. One IBMer said in time the company hopes to make everything from the 4300 to the personal computer available to system builders. IBM also enhanced the Datamaster via better word processing and larger disks supporting up to four workstations.

• BURROUGHS BRINGS OUT B20 LINE. Based on Convergent Technologies gear, the B20 series is being aimed at the small business market. The series features 16-bit 8086 processor, 15-inch high resolution display and main memory from 128K to 640K with Winchester disks available. Prices range from $8K to $12K. Burroughs claims orders for more than 1,000 systems and plans to sell the B20 directly, via four retail stores, and dealers and distributors.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

MOLLY UPTON, EDITOR MAY 19, 1982 ● VOL.18,NO.2 P.J. MCGOVERN, PUBLISHER

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Supercomputer update -- Page 6

PCMS TAKE 3% OF 1981 WORLDWIDE GENERAL PURPOSE SHIPMENT VALUE; NAS LOOKS TO HITACHI FOR NEW TOP OF THE LINE

What would IBM's price/performance level be today were it not for the competition of the plug-compatible manufacturers? Despite their seemingly insignificant 3% share of general purpose shipments, the PCMs -- with their implicit ties to the Japanese challenge -- are always there as a spur to IBM, prodding the giant to give users more for their money than might otherwise be the case.

That users enjoy the fruits of this competition doesn't make it any easier for the PCMs to swim in IBM waters. The ghost of the Itel demise still lingers, and the whole PCM business can suffer whenever one of the family shows any signs of going under. Yet any connection between Magnuson and Itel exists solely in the mind of the marketplace; Magnuson's problems are primarily the result of weak management; Itel was wiped out by high risk financing and IBM's introduction of its unexpectedly aggressive 4300 series.

In the wake of IBM's 3083, 3081, and 4300 announcements over the last six months and several recent PCM product announcements, it's time to look at what's happening on the PCM front. Some noteworthy points:

- NAS will market a high-end Hitachi-built machine, the AS/9060, that supports IBM's 31-bit addressing (MVS/XA) with power in the range of the IBM 3081D. Its dual processor version, the AS/9080, compares with Amdahl's 5870. Amdahl will put MVS/XA on its 470 series.

- Like other corners of the industry, first quarter financial blues hit Amdahl, IPL, and National Semiconductor; earnings were down, with revenues up slightly.

- The PCM peripheral business has been growing faster than PCM CPUs.

- In 1981, the combined $600 million general purpose sales of the PCMs exceeded the general purpose sales of either Control Data or NCR.

- New players continue to emerge, especially in the 4300 area which is increasing its share of the PCM CPU business in value and units.

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10-YEAR HISTORY, WORLDWIDE GENERAL-PURPOSE SHIPMENTS*
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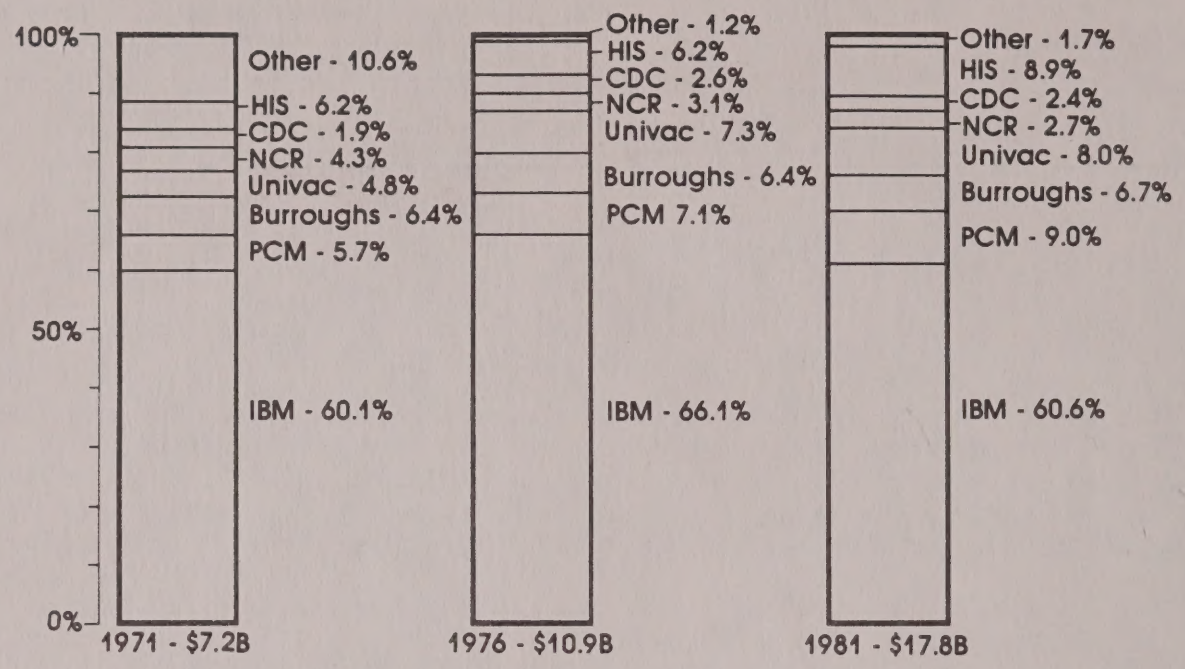

*Note: PCM figures include peripheral sales.

Who's who?

Perhaps it is a tribute to today's PCMs that the thought of going head-to-head with IBM seems less intimidating than before. There are, in various stages of development, at least thirteen U.S. suppliers of PCM machines, up from four as recently as the late 1970s. The chart below shows the changing list of players with the parentheses indicating the major hardware supplier.

Late 1970s	Early 1980s	
Amdahl (Fujitsu)	Amdahl (Fujitsu)	Cambex (IPL)
Itel (National Semi)	NAS (Hitachi)	STC
CDC (IPL)	IPL	Trilogy
Two Pi	Four Phase (Two Pi)	Spartacus
IPL	Magnuson	Nixdorf
	Formation	Nanodata
	TRW-Fujitsu	

Also not to be overlooked are members of the Bunch (Burroughs, Univac, NCR, CDC, Honeywell). Burroughs now has Memorex and its PCM peripheral business; NCR's Comten specializes in IBM-compatible front ends; and CDC is a major IBM peripheral player and did a sizeable PCM CPU business before IPL's decision to concentrate on end-user sales caused CDC to lose interest in its IPL-built Omega series. New entrants are appearing on the PCM peripheral front as well. Ibis (Duarte, CA) says it will market a 5 gigabyte IBM compatible disk and is now involved in a trade secret dispute with STC. Though the 3380-type disk technology is difficult, other new vendors may well emerge.

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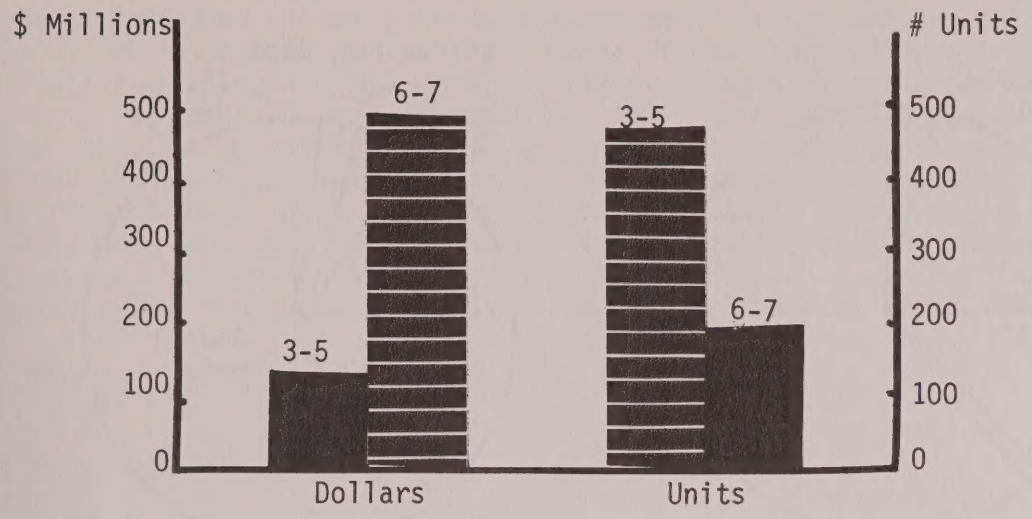
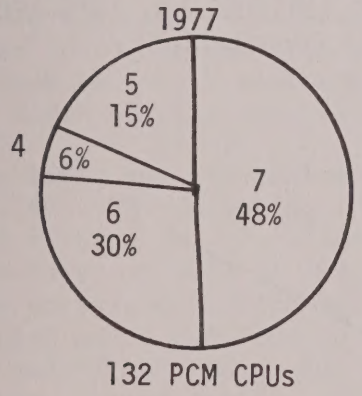
WORLDWIDE PCM SHIPMENTS BY SIZE CLASS -- 1981
(Copyright 1982 -- International Data Corporation)

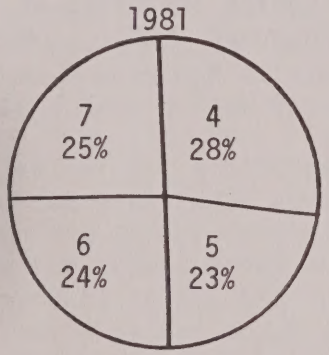


It is perhaps ironic that the 4300s have captured so much PCM attention since the 4300s are generally credited with knocking Itel out of the PCM business by decimating residual values for the 360 and 370 series machines. But whether it is the relative simplicity of making size class 3 through 5 machines or the sheer bulk of sales in this area, 4300-size machines have become a much more important part of the PCM business for both CPUs and peripherals. Nevertheless, as the chart above shows, in terms of dollar value, size classes 6 and 7 remain dominant.

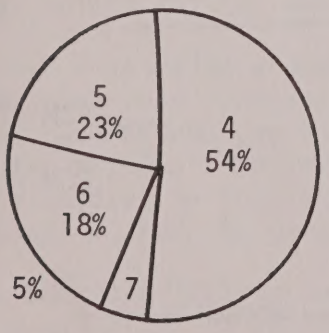
IBM, PCM U.S. INSTALLED CPU BASE BY SIZE CLASS, 1977-1981
(Copyright 1982 -- International Data Corporation)



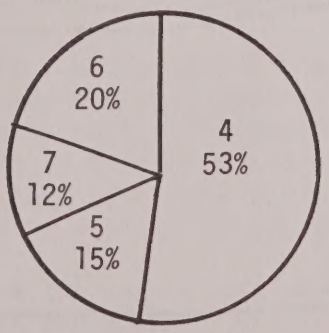
132 PCM CPUs



1,330 PCM CPUs



13,250 IBM CPUs



15,800 IBM CPUs

Model	Size Class
4331-2	4
4341-1	4
4341-2	5
3031	6
3032	6
3033	7
370/138	4
370/148	5
370/158	6
370/168	7
470V/5	6
470V/6	7
AS/3000	4
AS/5000	5
AS/7000	6
AS/9000	7
IPL 4436	4
IPL 4443	4
M80/4	5
M80/31	4
M80/32	4

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SEGMENTATION, VALUE OF U.S. PCM INSTALLED BASE, 1979-1981
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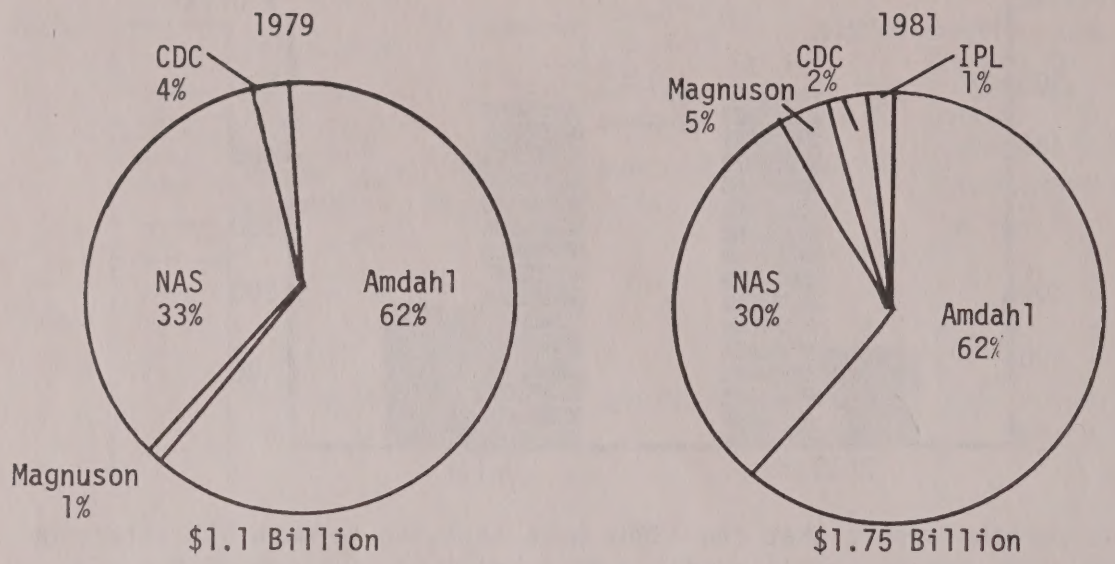
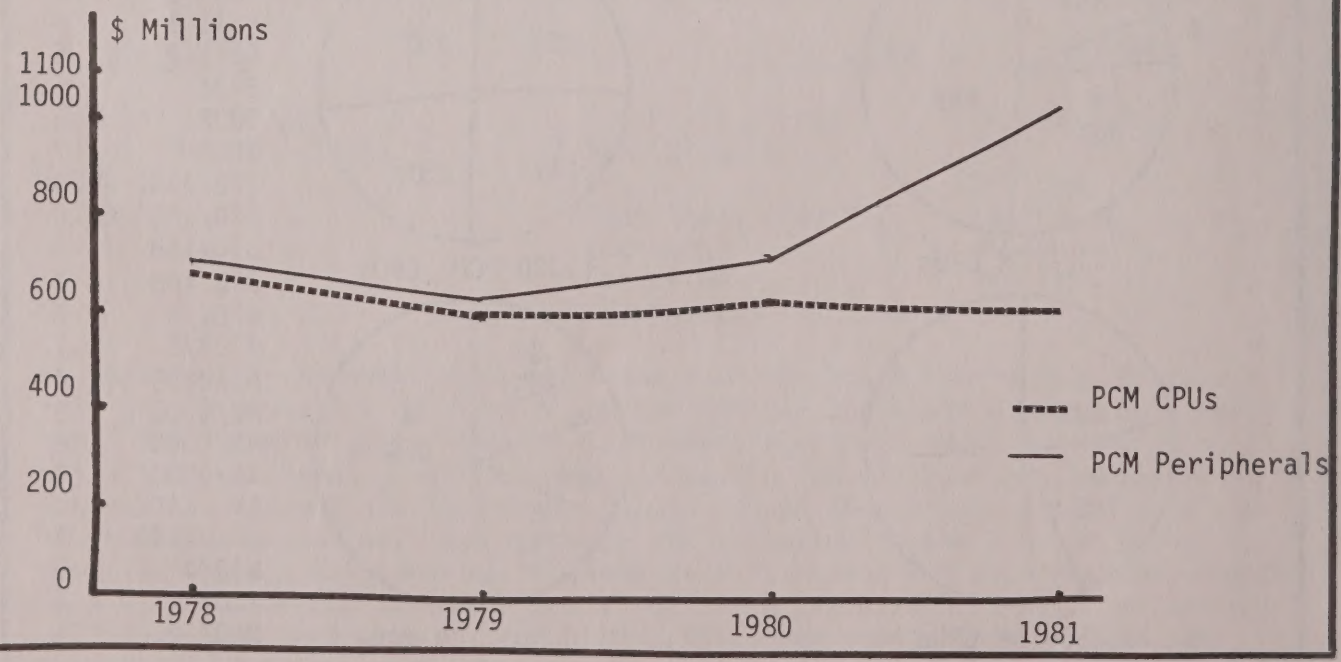


The value of the PCM installed base grew 26% per year between 1979-1981. In terms of units, spurred by the emphasis on size class four and five machines, the base has grown 78% per year since 1977. But it should be noted that the PCM installed base is too new to be significantly affected by retirements. Therefore comparisons to the rest of the mainframe installed base, which is growing at only 6% in value and 15% in units, can be misleading. The shipment data below is perhaps a better indicator of the actual PCM growth.

VALUE OF WORLDWIDE SHIPMENTS OF PCMS: CPUs AND PERIPHERALS, 1978-1981
(Copyright 1982 -- International Data Corporation)



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PCM round-up

National Advanced Systems' new Hitachi-built uniprocesor 9060 and dual processor 9080 beef up the company's high-end offerings and answer the challenge of IBM's extended addressing. Users of the older 9000 series machines can field upgrade to the new models. The extended addressing features are priced at $250,000 and are scheduled for 1984. NAS also announced price cuts in the 10% range on existing 9000 series machines seemingly in response to the IBM 3083 announcements made in March. NAS claims to have installed more than 45 AS/9000 machines since December of 1980. In April, the company introduced its U.S.-made AS/6100 line to compete with the 4341-2 and the low end of the gap between that machine and the 3083E. Key features of the 9000 series are provided below; for comparisons with IBM, see EDP/IR Vol. 17, No.24, page 4.

Model	Memory	Channels	IDC Perf. Rating	Price	Available
AS/9000N	4	8	314	$1,950,000	12/80
AS/9000	16	16	393	$2,750,000	12/80
AS/9000 DPC	16	16	708	$4,150,000	12/80
AS/9060	16	16	510	$3,550,000	4Q/82
AS/9080	16	16	920	$5,250,000	4Q/82

Unlike NAS and IBM, Amdahl has said it will offer extended addressing on its older line, perhaps to breathe new life into its four-year old 470 series in the face of I/O-caused delays in 5860 deliveries. 470/XA delivery dates will not be announced until IBM begins its shipments in first quarter 1983. Since interpretive emulation is involved, a performance degradation is expected, the extent of which will be announced before actual shipments. 470/XA is priced at $250,000 plus $250/month maintenance. In contrast, IBM's MVS/XA JES 3 goes for $5,500/month, after an initial $13,500 charge.

The other Amdahl news is a mix of good and bad. In April, the company received its largest contract ever; as a subcontractor to Electronic Data Systems (EDS), Amdahl will over the next 10 years supply the U.S. Army with 20 computers in a deal estimated to be worth more than $45 million. On the dark side, first quarter results show net earnings down 56% on revenues up 15%.

In 1981, end user sales accounted for 68% of IPL's $17M revenues, up from 7% in 1980. Establishing its direct sales force has been expensive and is one of the reasons why IPL's earnings were down 47% in the first quarter even though revenues were up 10%. IPL has made two recent moves of note. It has signed an agreement with Mitsubishi to cooperate on ECL LSI chips, making it the third major U.S. PCM to have an important Japanese connection (the others being Amdahl and NAS). But IPL stresses that Mitsubishi holds no stock in IPL and that, unlike Fujitsu and Hitachi, Mitsubishi is not in the PCM business.

IPL has also added a new pricing gimmick to its 4331-2 competitor, the 4436. A "peak load processing" (PLP) feature enables users to get added power when they need it and pay for it at an hourly rate. The PLP option almost doubles the machine's performance at a cost of $18/hour. In effect, IPL is pricing according to functionality rather than cost; the PLP power is always in the machine, but the user only pays for it when it is needed.

Gene Amdahl's Trilogy has broken ground in Ireland and says production and financing are right on schedule with a high-end machine promised by 1984. Magnuson has yet to report its first quarter results .

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SUPERCOMPUTER ACTION HEATS UP; CRAY TOPS $100 MILLION IN REVENUES

Supercomputers have always been an exotic and not particularly important part of the EDP industry. Even today there are only about 35 supercomputers installed in the U.S. Despite their blazing speeds, the technological impact has also been mild, with supercomputer speeds more due to different architecture and larger size, rather than the implementation of new technologies.

The importance of supercomputers has been diminished by their inability to compete in the general purpose marketplace, even with scalar computation speeds of up to 80 MIPS. Except when coupled with array processors, today's general purpose machines are not capable of the vector computations for which supercomputers are usually bought, and mingling array processors with general purpose CPUs is a concept that has only recently shown signs of taking hold.

But despite this apparent limitation to the scientific vector processing market, the demand for supercomputers seems to be expanding faster than many people expected. Cray has said that it believes that there are some 200 potential customers for its machines, and CDC has said it expects to ship 50 supercomputers over the next five years. At an average price of more than $10 million, the market is starting to look substantial, as shown by Cray's topping the $100 million mark in 1981, not bad for a company that didn't sell anything until 1976. CDC expects to have eight Cyber 205s installed by year's end.

Oil, aerospace, automobile, and chemical companies have heightened their interest in supercomputers over the last two years, joining the demand from traditional government, military, and university users. Additionally, service bureaus such as CDC's Cybernet and a few others have made supercomputer power available to less well heeled users. Both Cray and CDC hope that the commercial market will eventually get a boost from economic, data base, medical and financial modeling applications, but this demand has yet to materialize.

Today's applications are divided relatively equally between the following eight categories: circuit design, geophysical research, linear programming analysis, structural analysis, nuclear research, engineering design, atmospheric research, and general purpose academic use.

Though there are only two main competitors, CDC and Cray, competition in the supercomputer business resembles that in other portions of the computer industry. Software availability and compatibility is almost as important an area as price/performance. And as the commercial users become more important, available third-party application software is also becoming more of a factor.

Consequently, entrenched software investment will command a certain amount of vendor loyalty. The general consensus seems to be that it would take speed improvements of at least five to ten fold to make it worth rewriting existing code for a new machine. On the other hand, in the supercomputer market, speed improvements are generally discussed in terms of orders of magnitude, and if a vendor provides a ten or 100 fold improvement in performance, many users would be more than willing to jump.

The military has already let it be known that it is interested in machines 100 times faster than today's entries. Such a machine would offer something on the order of 4 billion floating point instructions per second (4 gigaflops).

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SUPERCOMPUTER TERMS AND DEFINITIONS

As a rule, supercomputers are distinguished from general purpose machines by their ability to simultaneously perform vector and scalar computations. General purpose machines do scalar calculations. Some supercomputers also make use of parallel processing. Definitions of the three methods are given below:

Vector processing concurrently applies a single instruction to multiple operands. The Cray-1 can execute one instruction on 512 words at a time.

Scalar processing consists of the sequential mode of general purpose CPUs.

Parallel processing implies that the computer can simultaneously execute different instructions, usually five or less.

NASA is taking bids for a one gigaflop processor for its wind tunnel simulator to be completed in 1985. Looking at today's reality, Cray says that its Cray 2, which will be out in two years, will be six to twelve times faster than the Cray 1 introduced in 1976. Its recently announced X-MP multiprocessor is said to be about five time faster than the Cray-1S, measuring in at 200 MIPS and priced in the $11 million to $15 million range.

Since the first Eniac was built in 1946, supercomputer speeds have improved by seven orders of magnitude, or roughly two for every ten years. Many question just how long this pace can be maintained, but 100-fold improvement by the end of the decade has its believers. Gallium-Arsenide and Josephson Junction circuitry will help, but the most important contributions will come from improved software and system architecture. When 100 gigaflop machines arrive, odds are they won't be compatible with the supercomputers of today.

Given these mind boggling speeds, perhaps it's not surprising that I/O devices have been one of the main system bottlenecks in some applications. Both Cray and CDC machines have traditionally used standard CDC disk and tape subsystems with either a mainframe or specialized device as a front end. But along with its X-MP announcement, Cray announced a MOS-based solid state storage device (SSD) that promises 30 to 100 fold improvements in data transfer speed, or 100 million to 1.2 billion bytes per second. By contrast IBM's 3380/3081 combination can tranfer data at 3MB per second. The SSD comes in 64MB, 128MB, and 256MB versions, and uses 6MB, 100MB, and 1,250MB CPU channels.

Whether it is the market opportunity or just the chance to claim the "world's fastest computer," the supercomputer market is unlikely to remain a two-horse race. In fact, a third entry already exists. Denver-based, Denelcor has taken a parallel approach and in its largest 16-processor configuration it can offer 100 megaflops per second. At this time, Denelcor's only known contract is with the U.S. Army.

Burroughs is no stranger to the supercomputer business; it built both the Illiac IV and the PEPE systems for the government. More recently, in 1977 it announced the Burroughs Scientific Processor as an add-on to its general purpose machines. Only one test-site BSP was delivered and last year the company cancelled further production of the system. The Japanese are also considered a threat, but Cray CEO John Rollwagen says he believes that the Japanese are only talking about a machine six or seven times faster than the Cray-1 by 1990 and that Cray has at least a three to five year lead over this plan.

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• DIGITAL PLOWS INTO PERSONAL COMPUTER MARKET. You know that desktop computers have arrived when the president of the world's largest minicomputer company calls its new line of desktops "the most significant products Digital has produced to date." DEC is targeting the CP/M-packaged software world (Rainbow), the word processing/clerical market (Decmate II), and its own PDP base (Professional 325 & 350). Given the low-end Vax announced in April, the squeeze on the PDP series now looks serious. DEC has made arrangements with 22 independent software producers and it will set up a "seal of approval" system for independent packages. Computerland and Hamilton Avnet typify the distribution strategy. Highlights of the three new machines are summarized below.

	Rainbow 100	Decmate II	Professional 350
Processor	Z80 & 8088	6120 (PDP-8)	F-11 (PDP-11/23)
Min/Max Memory	64-256KB	96KB	256KB
Operating Sys.	CP/M, 86/80	COS 310, WPS-8	P/OS
Floppy Storage	Dual 5.25", 800KB	Same	Same
Winchester option	5.25", 5MB	Same	Same
VT102 Emulation	Yes	Yes	Yes
VT125 Emulation	Optional	No	Optional
Minimum Price	$3,495	$3,745	$4,995
Delivery	3Q 1982	3Q 1982	3Q 1982

DEC has designed its discount plan to be competitive with any in the industry, and it claims it will be almost double that of IBM. All three products use the same keyboard and screen, an important feature to retailers concerned about inventory loads. The systems have self-diagnostics and DEC is offering 800 number service for software bugs.

• SMITH CORONA HALVES LOW-END PRINTER COSTS. Showing the strengths of its typewriter roots, SCM is offering its TP-I, a letter quality, 12 character/second daisy wheel printer, for just $895. The printer will be sold through both dealer and OEM channels and SCM says that through its RS232C and Centronics compatible interfaces, the TP-I will be compatible with most desktop, word processing, and small business systems.

• JAPANESE CHIP MAKERS EXPAND U.S. PRODUCTION EFFORTS. A lot of Japanese 64K RAMS will soon be made in the U.S. NEC (CA), Fujitsu (San Diego), and Hitachi (Dallas) are all expected to commence 64K production by this summer. Toshiba has also completed a new facility, and Mitsubishi will soon begin its joint U.S. chip venture with Westinghouse.

• CDC ROLLS OUT 700 SERIES REPLACEMENTS. Just when services and peripherals had begun to steal the show, CDC unveiled a five-member product family that spans the range from the 4300 to well beyond the 3081K (or as CDC puts it 1.4 to 32 MIPS). The series appears to obsolete everything except the company's Cyber 205 supercomputers. The five members include: the 825 (1.4 MIPS, $370K); the 835 (3 MIPS, $820K); the 855 (8 MIPS, $1.9 million); the 865 (11 MIPS, $2.5 million); the 875 (19 MIPS, $3.2 million), and the dual 875 (32 MIPS, $4.5 million). The IBM 3081K is rated at approximately 15 MIPS. A new disk subsystem (two spindles, 8.3 gigabytes), a multi-function terminal, an impact printer, and a new version of its NOS operating system were also announced. All products will be delivered by at least first quarter 1983, many sooner.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

MOLLY UPTON, EDITOR APRIL 30, 1982 ● VOL.18,NO.1 P.J. MCGOVERN, PUBLISHER

IBM MAINFRAME DISK STORAGE GROWING AT 56% PER YEAR; 4300s SPUR RUNAWAY DEMAND

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By the end of 1982 the data stored on IBM mainframe disks will total more than 20 times that of all the volumes on the 270 miles of shelves in the Library of Congress -- nearly 100 million megabytes, according to EDP/IR's best estimates.

And if the 1980 to 1982 period is indicative, other milestones will fall in quick succession. Disk storage capacity among the U.S. IBM mainframe base is growing at 56% per year, more than doubling over the two-year period.

No wonder then that Storage Technology will soon be a $1 billion company and that Control Data did more than $1 billion in peripheral business last year. The opportunities for growth in the disk market remain substantial, and IBM alone will not be able to meet the need.

The pages that follow chart the trends in mainframe disk storage, and were compiled by EDP/IR from the year-end 1981 U.S. disk and mainframe statistics of International Data Corporation. Among the points that surfaced:

- The PCMs are increasing their share of the 3350 market (page 2)
- Over the 1970 to 1980 span, IBM main memory prices fell twice as fast as disk prices. (page 3)
- By 1982 the 4300 series will lead both the installed disk and CPU markets in terms of number of spindles and CPUs. (page 4)
- Led by the 4300s, total storage on size class 3,4,5 machines is increasing much faster than for size class 6,7 systems. (page 6)
- In terms of actual use, the average 3081 will support twice the amount of data as the average 3033. (page 6)
- Relative to the CPU, disk share of system cost is increasing. (page 7)
- Installed disk storage is increasing faster than installed processing power -- 56% vs. 39%. (page 7)

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AVERAGE MEGABYTES DISK STORAGE PER CPU, IBM PRODUCT FAMILIES
(Copyright 1982 -- International Data Corporation)

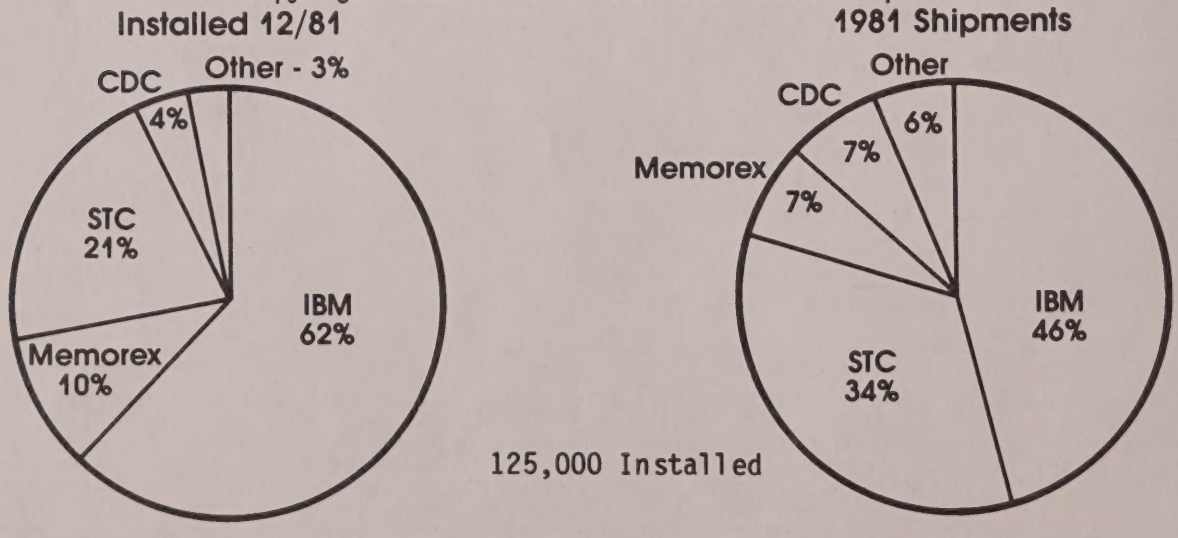
Model	Size Class	Date of First Installation	IDC Performance Rating	MB Disk/CPU
370/138	4	11/76	11.7	480
370/148	5	3/77	24	1,360
370/158	6	5/73	41	4,610
370/168	7	7/73	109	6,190
3031	6	3/78	54	3,990
3033	7	3/78	237	13,750
4331	3	4/79	11	1,855
4341	4	10/79	40	2,950
3081D	7	11/81	465	27,550

The information above allows for size class comparisons. The 4331 is supporting far more data than its equivalently powered 370/138 ever did, while the 4341 does not appear to be anywhere near saturated since an average 4341 holds only about 65% of the data of the similarly empowered /158. In the size class seven range, the average storage per CPU seems to double with each new family of CPUs, witness the movement from the /168 to the 3033, to the 3081.

If anything, comparisons of the new systems to the old understate the actual case since EDP/IR has observed that the MB/CPU ratio rises steadily over time as users experiment with systems capacities. In fact the figures are still rising slightly even for 370 machines.

Also of note is the PCM penetration. Because of 3350 production cut backs in anticipation of the 3380, IBM has not been able to meet 3350 demand, allowing PCM vendors to grab over half the market in terms of 1981 shipments. As for 3380s, IBM began shipping them in October. CDC says it will ship its version internally in the 4th quarter of 1982, with first customer shipments in the first quarter 1983 and volume shipments in the second half of 1983. Memorex says that though its 3380 program is "underway" it is not announcing any delivery times. STC promises shipments by the 1st quarter 1983, with volume production in the second half of the year.

U.S. PCM PENETRATION, 3350 DISK
(Copyright 1982 -- International Data Corporation)



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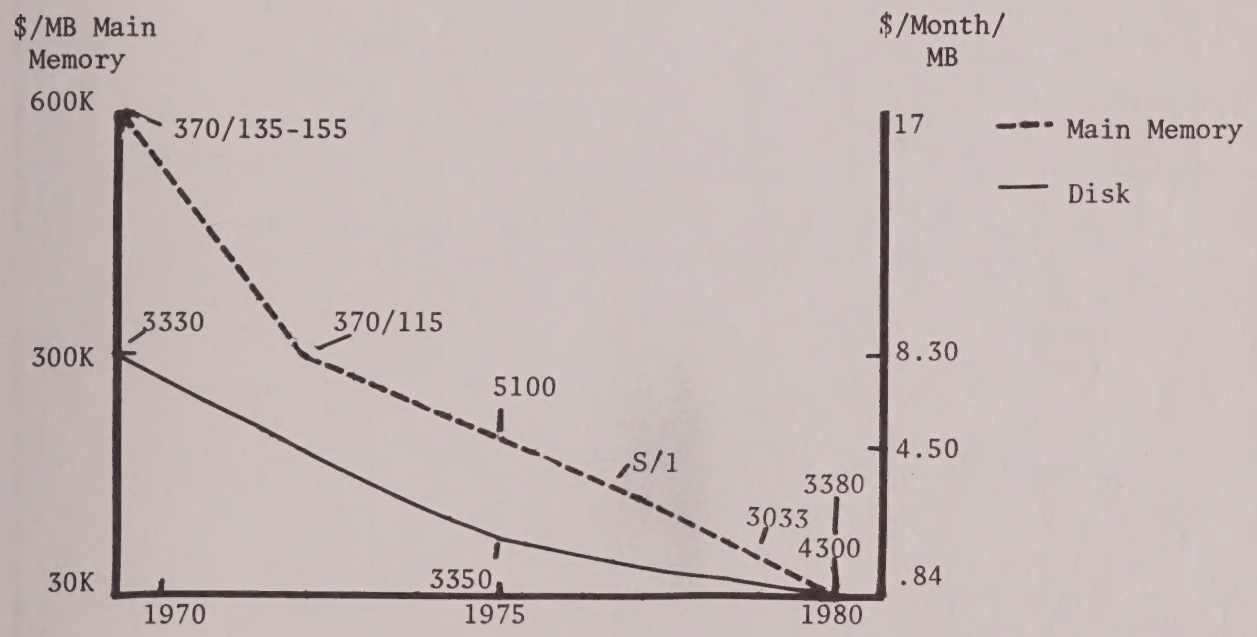
DISK PRICING HISTORY
(Copyright 1982 -- International Data Corporation)

Year Announced	Device	Capacity (M byte)	$/Month/Mbyte
1956	IBM 350	5.0	153.00
1964	IBM 2311	7.3	75.00
1965	IBM 3214	29.1	23.00
1970	IBM 3330-1	100.0	8.30
1973	IBM 3330-11	200.0	4.85
1973	IBM 3340	70.0	7.50
1975	IBM 3350	317.0	2.25
1978	STC 8650	635.0	1.50
1979	IBM 3370	571.0	1.65
1980	IBM 3375	820.0	1.26
1980	IBM 3380	1,260.0	.84

PRICES OVER TIME, MAIN MEMORY VS. DISK 1970-1980
(Copyright 1982 -- International Data Corporation)



How to read this chart: the left-hand scale applies to the main memory curve, while the right hand scale is for disk. The two scales are proportional in that there is a 20:1 ratio between the top measure and the bottom, i.e., 600K/30K = 20, and 17/.84 = 20. Thus the chart shows that over the last ten years the price of CPU memory has come down about twice as fast as the price of disk storage.

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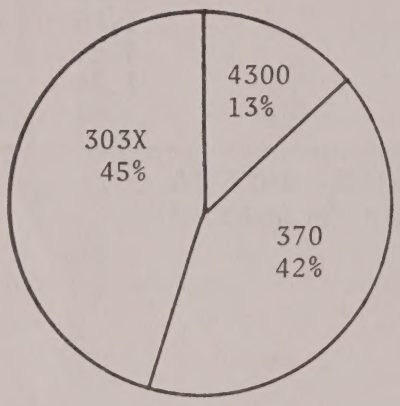
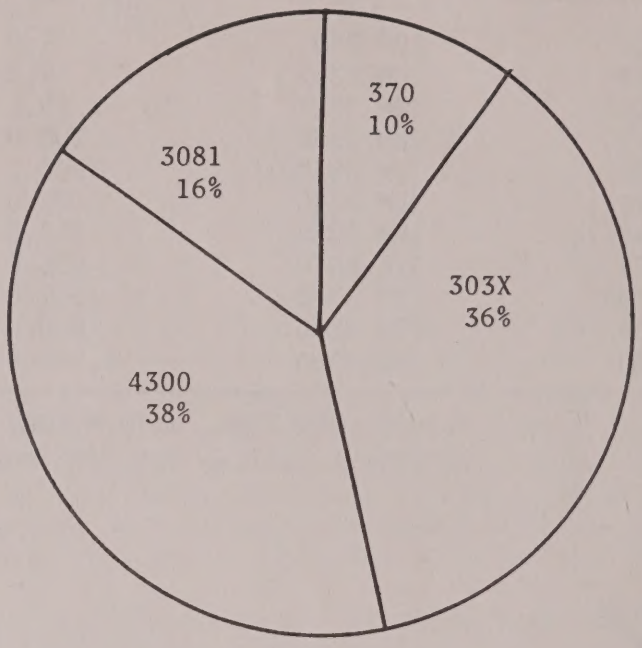
SEGMENTATION INSTALLED U.S. IBM MAINFRAME DISK STORAGE, 1980-82
(Copyright 1982 -- International Data Corporation)

1980



34.4 Million Megabytes

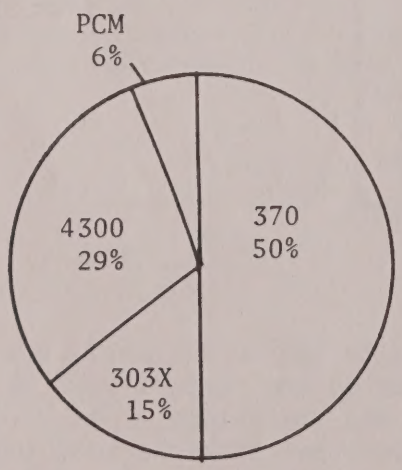
1982



84.3 Million Megabytes

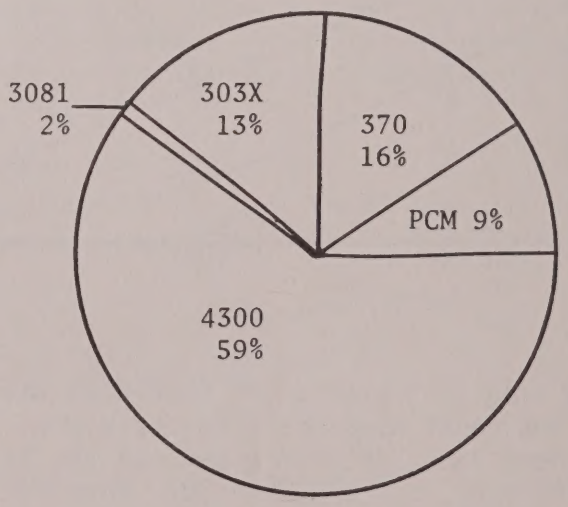
SEGMENTATION IBM CPU U.S. INSTALLED BASE, 1980-1982
(Copyright 1982 -- International Data Corporation)

1980



16,130 CPUs

1982



22,190 CPUs

Taken together the charts above show just how rapidly the 4300 series is supplanting the 370 series installed base as it becomes the leading product family in terms of both total disk storage and number of CPUs installed.

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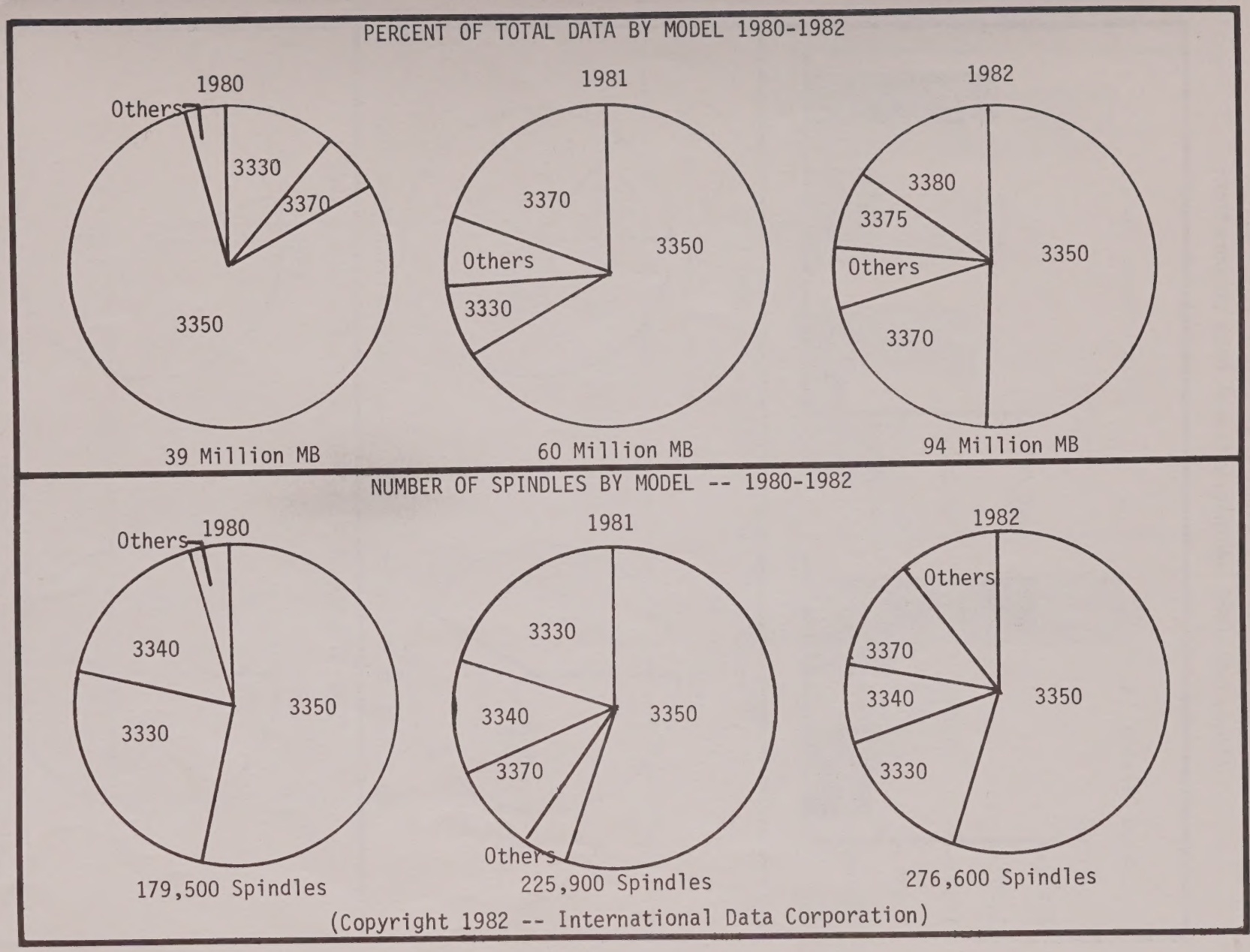

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TRENDS IN IBM DISK STORAGE BY SIZE CLASS, 1980-82
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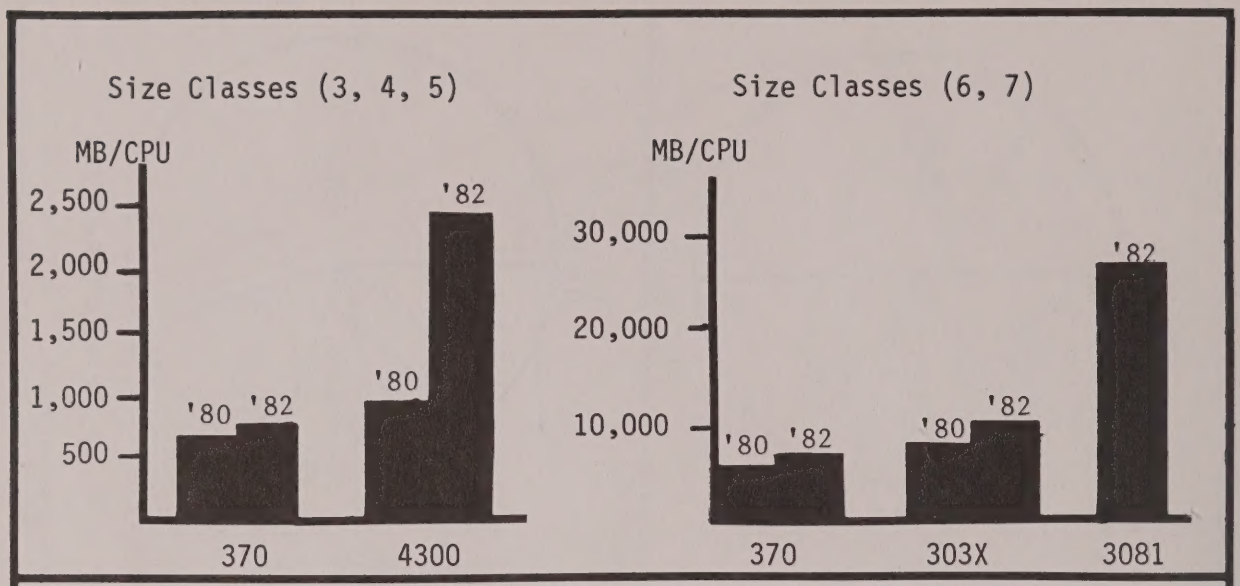

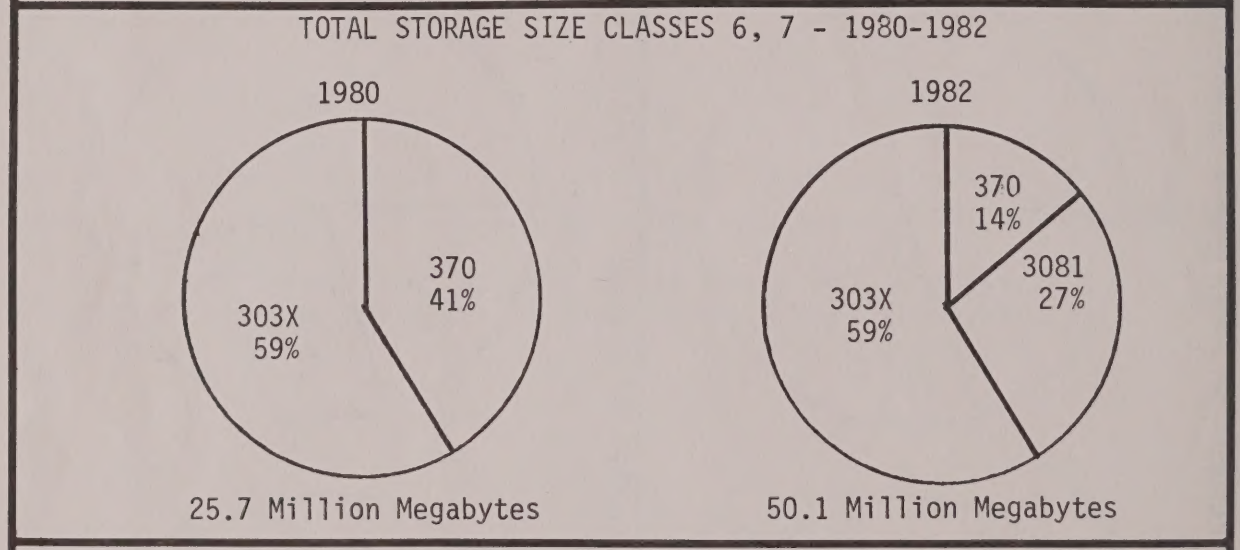

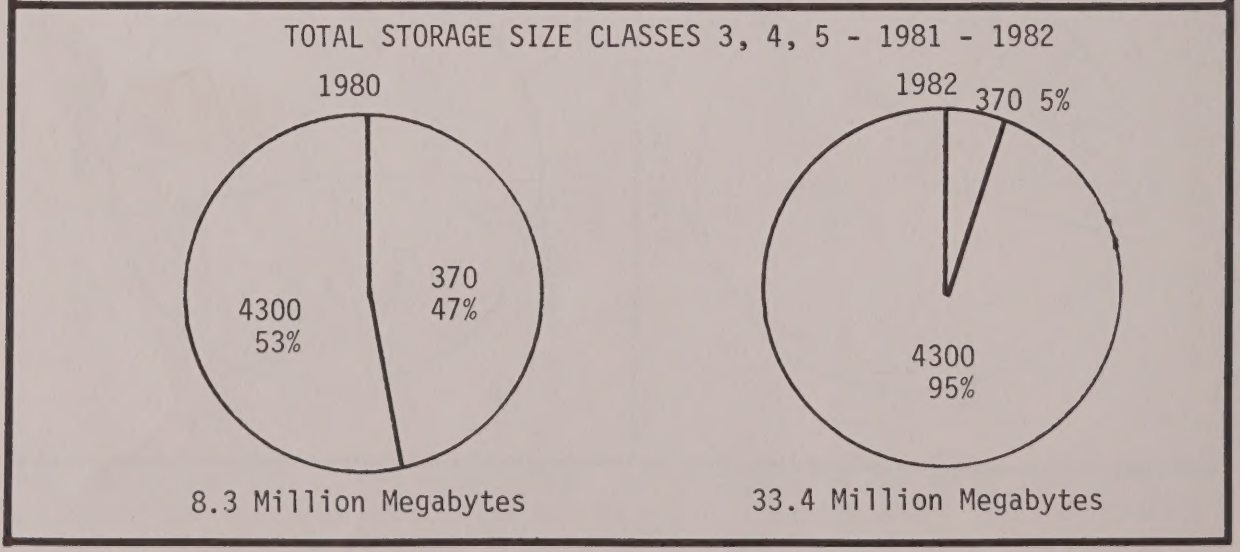

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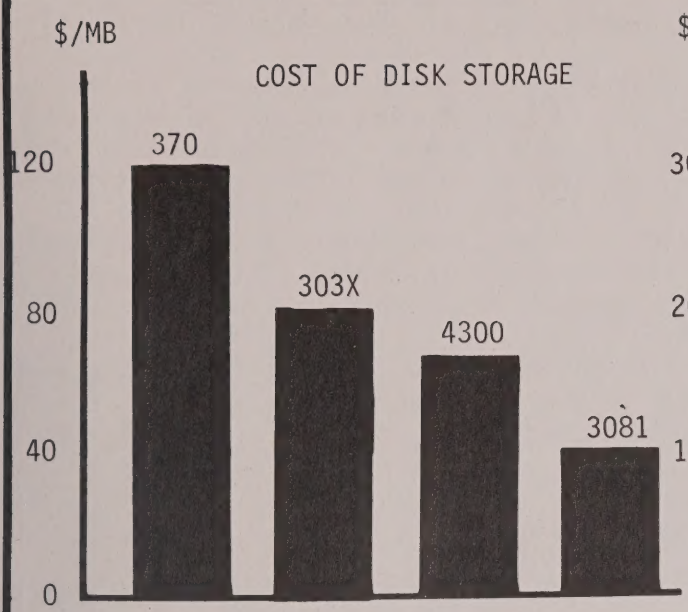
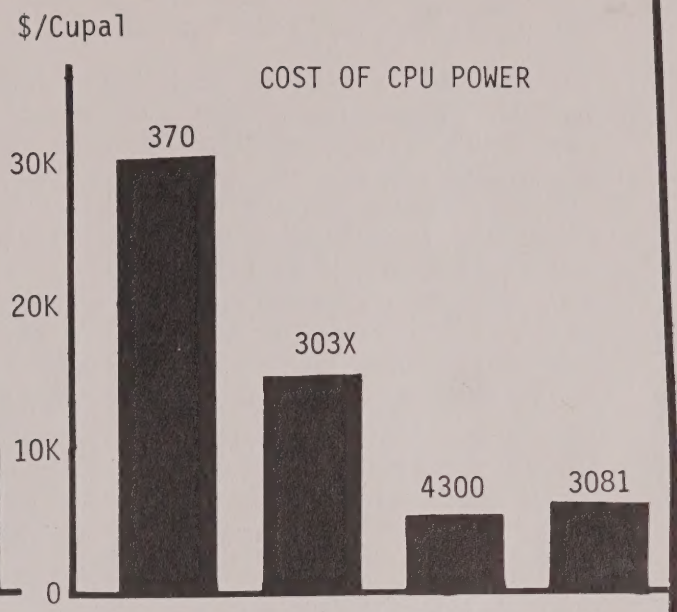
TRENDS IN DISK AND CPU PRICES, 1980-1982



Figures based on average disk costs per CPU family. Disk costs are based on original list prices. Controller costs not included.



Based on original CPU prices of barebones CPUs, (processor, minimum memory, standard channels).

INSTALLED IBM DISK & CPU POWER 1980-1982

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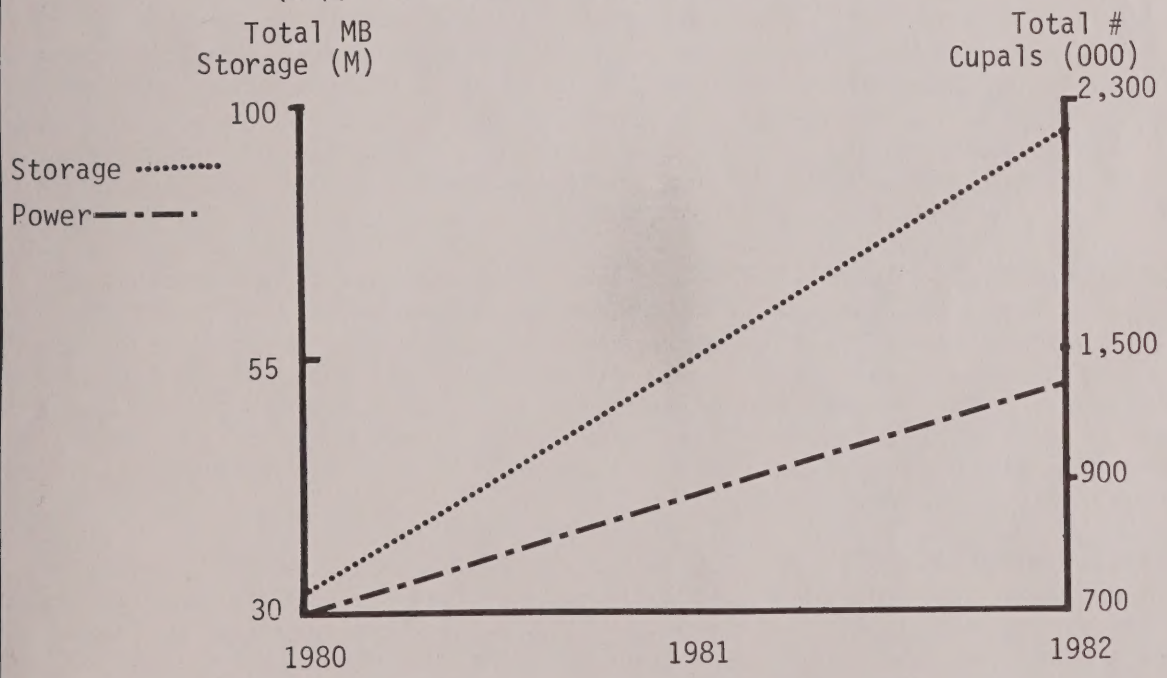

IDC coined the term "cupal" for use as relative measure of CPU performance. One cupal is equal to the power of a 360/20. The number of cupals installed is derived by multiplying the cupal ratings of individual models by the number installed and then adding the totals.

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• NAS ADDS MID-RANGE LINE. The two machines in National Advanced Systems new AS/6100 series target the low end of the gap between the 4341-2 and the new 3083E. In power, the /6130 matches the 4341-2 and the /6150 is said to be about 30% faster; the former is field upgradable to the latter. The price for the /6130 with 4MB and six channels is $325,000 (about 20% less than 4341-2), while the that for the /6150 is $390,000 for the same configuration. Deliveries for the /6130 will be in the 4Q/1982, and the /6150 will follow in the 1Q/1983. The AS/6100 machines will be made at the company's San Diego plant.

• INTEL TAKES ANOTHER STEP TOWARD SYSTEMS BUSINESS. Showing its belief that 5.25 in. Winchesters will be important to future microcomputer systems, the chip maker has spent $4.8 million to get a 20% share of Computer Memories Inc. (CMI), a supplier of 5.25 in. drives. Intel also has the option to buy a majority interest in the company after two years and has made an agreement to purchase CMI drives with the option of eventually manufacturing them.

• DIGITAL RESEARCH TO PUT CP/M ON 68000 FOR HITACHI. Software compatibility will be a key part of the Japanese desktop strategy. The 8-bit CP/M was developed by Digital Research (DR) in 1975, and 16-bit versions are available now for 8086 and 8088-based machines. The 68000 version will be called CP/M-68K. The U.S. firm is also expected to develop a version of Pascal for the 68000 and both products are expected by the third quarter of this year. DR has also developed a concurrent version of CP/M-86 and has agreed to come up with a multi-tasking operating system for the Intel iAPX 286 chip. DR's recent reorganization has recognized the company's expanding interests.

• APOLLO DOUBLES SYSTEM POWER. The 32-bit single station nodes now can have up to 3.5MB main memory using 64K chips and a 10MHz processor, up from 1MB and 8MHz. Apollo has been having most of its success in the university and engineering markets and recently sold its 130th machine. Also announced was a new 19-inch monitor and the popular MSC/Nastrain finite element modeling package, a very large program (400,000 Fortran source statements) that usually runs on mainframes in the 3033 range.

• FRENCH NATIONALIZE CII-HONEYWELL BULL. Honeywell has reduced its long-standing 49% stake to less than 20%, as the socialist government takes a controlling interest in the French computer industry. Cie Generale d'Electricite and Thomson Brandt were previously nationalized. Honeywell received $150 million for its shares, and may well be relieved since the French concern has been a drain on earnings of late. The French government has said that it does not feel the agreement will cause Honeywell to curb its technological and developmental relations with CII.

• UNGERMAN-BASS, FUJITSU TEAM FOR LOCAL NET CHIPS. Fujitsu will manufacture an Ungerman-Bass (UB) designed two-chip set for non-proprietary local net connections. According to UB, the chips will be used in 10MB/sec baseband systems and will be compatible with both Ethernet and the expected IEEE 802 committee standard. UB says that the deal with Fujitsu will be "long term" and that it will help the push for international standardization. The circuits are "partitioned" for ISO levels one and two, since only these layers have been standardized. Commercial availability of the chip set is expected by the fourth quarter of this year.

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